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Engineering News-Record

Piledriver "Mammoth"
Up-Ending a 110-ft. Pile,
Manila Pier Construction

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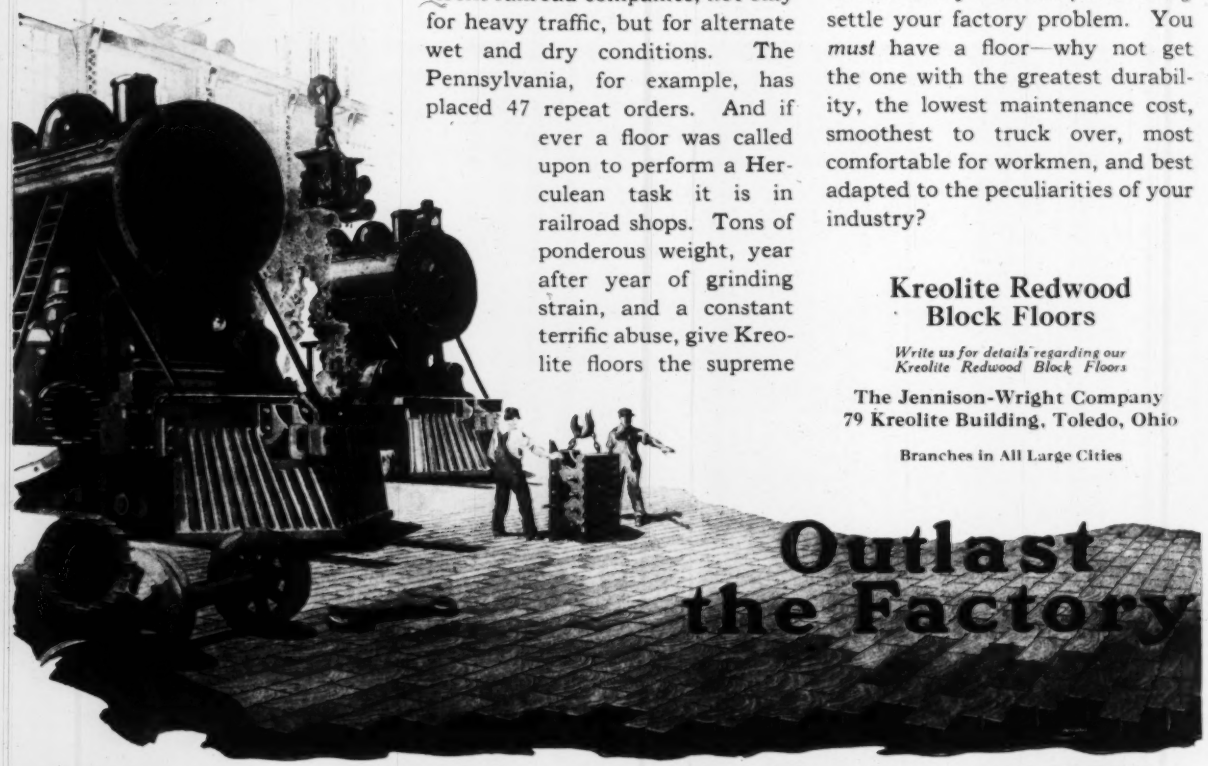

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

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A Friend and Benefactor

IN THE death of Maj. W. H. Wiley, the veteran publisher of scientific books, the engineering profession loses not only an associate but a benefactor. In the long period of his professional life, technical books have improved quite as much as has the science and practice of engineering. Indeed, the progress is probably greater for whereas there was excellent engineering done prior to the Civil War, there was practically no book publishing in the engineering field worthy of the name. Major Wiley's house, founded near the beginning of the century by his grandfather, has been a commanding figure in the change which has resulted in the wealth of such literature that is now available to the engineer. The Major himself brought to his firm the enthusiasm of youth, a character forged in the fire of war and the sound education and training of the engineer. That combination soon began to have its effect on technical publishing—and engineers everywhere have been the gainers. Major Wiley's name will go down in the annals of the profession, along with a long line of revered professors, as one who served it well.

More Time for Bids

LACK of time to estimate costs and to prepare bids is a frequent complaint of contractors doing engineering construction. Sometimes this restriction comes from a desire to limit competition or from other ulterior motives, but most often it comes from a lack of understanding by the owner or from mere thoughtlessness by the engineer or architect. A hastily prepared estimate is generally a poor estimate. Either the bidder plays safe by setting the price high, in which case the owner loses, or he overlooks something and puts it too low and then the contractor is the victim. Time is required to make a true cost estimate. The length of time as it appears to a committee of the Southern California Chapter of the Associated General Contractors is given in another column for eight classes and seven prices of buildings. It ranges from six to thirty days. The exact figures are worth noting. None of them will strike experienced, conservative contractors as too large, if an estimate is prepared and not merely a guess is being made. Neither do they unduly delay the owner in getting his project under construction. Moreover he ordinarily can well afford the time—it attracts the contractors who will not make snap bids and it gives everyone time to figure closely.

Big Construction Contracts

LAST week there was let in Philadelphia a $16,863,437 contract for subway construction. It is, except one, the largest straight construction contract ever awarded. Only the contract for the vehicular tunnel in New York outvalues the Philadelphia undertaking. These statements are certain to carry recollection back to other construction contract agreements where the sums involved were nominally greater. Before presenting their claim, however, let it be observed that restriction has been made to straight construction contracts—those in which the contractor builds only. Most of the big contracts whose values have become traditional by repeated quotation have been as much undertakings in financial underwriting as in actual construction. Such was the often-cited contract of John B. McDonald for the first New York subways. The vehicular tunnel and the Philadelphia subway contracts require only the building of a specified structure at a named price. Among such contracts their amounts of nineteen million and seventeen million dollars, respectively, have not been exceeded. If crowded for defense, however, it may reasonably be claimed that the subway contract let last week is only the extension of the contract taken last fall by the same contractor for the joining length of subway, at a price of $14,215,099. In every practical aspect the two agreements are one contract and one continuous construction operation. The fact that they have called for hardly a paragraph in the newspapers marks the change since John B. McDonald's bid of fifty million dollars had its magnitude proclaimed by the press of all the world.

Safer Water Supplies

TWO indications of progress in making water supplies safe that were notable at the Louisville convention of the American Water Works Association were (1) the adoption of a resolution against cross-connections between public water supplies and any other water supplies unless it is a safe potable supply and (2) evidence of the increasing use of secondary chlorination. The resolution is in line with action taken a few years ago by the Conference of State Sanitary Engineers, with the regulations of at least one State Board of Health and a growing number of cities. The need for preventing cross-connections is illustrated anew by typhoid outbreaks and deaths due to such connections, as our columns testify every few months. As for secondary chlorination, it becomes more evident as population and sources of pollution on one hand and a demand for safer water on the other increase, that water must not only be safe or made safe at its source but also that measures must be taken to offset possible infection on the way to the consumers, whether in transit through conduits liable to ground water infection or by exposure in open reservoirs. In well joined iron or other pipes under pressure the dangers from ground water contamination are usually small, though they may exist if the pressure is not kept up; but in gravity-flow conduits of masonry or any other more or less porous material, whether in the body or at the joints, contamination may arise at any moment. Open reservoirs, too, are subject to infection—air-borne if no other—and some reservoirs, closed or open, may also be contami-

nated by infiltration. These dangers stand out with greater relief as others are brought under control and the bacterial indexes of infection from other sources are reduced almost to the vanishing point. Fortunately chlorination, primary, secondary or if need be in the third or higher degrees, is a low-cost and dependable safeguard, obviating or postponing the necessity for more expensive measures.

Something Besides Size

"CAPABLE management, or good fortune, in investment and operation, were apparently the major factors in determining the rate of profit, and they, rather than mere size, were the characteristic elements of business success." Thus the Federal Trade Commission in a report last week on war time profit and costs of the steel industry. How frequently is this essential truth forgotten, not only by publicists and legislators seeking the public good, but by the very men who run business. Too often we worship size and seek it with its illusory benefits and forget that there go with those benefits more than compensating detriments. In the steel business, particularly, the popular view is that the great corporation is the last word in business development but—and here is the testimony of the government's experts who looked especially into this one industry—its rates of profits are by no means far ahead of some of its lesser contemporaries. Mere size is a mockery. Beware how it is worshipped.

State Road Correspondence Schools

SCHOOLING in road building has been one of the notable developments of the era of intensive highway improvement in America. It has taken a number of directions. There come first of course the regular highway engineering courses of the technical schools. Then follow the variously arranged engineering school short courses. Most distinctive, however, of the spirit of giving better trained minds to road building are the annual meetings at "road schools" in many states to hear papers on and to discuss ways and means of construction and upkeep.

Anyone who has even occasionally sat in at these schools must have been struck with their advance in methods and quality. Today the winter road school of state and county highway officials offers as high a character of technical speculation and information as can be had, and in asserting this the colleges and national technical societies are not excepted. It would be interesting to rehearse growth and to offer examples, but the occasion of the present remarks is rather the new type of road school inaugurated this winter by the Missouri state highway department. This has been a "correspondence school."

Beginning early in January every responsible employee of the department has received, periodically, sheets of instructions covering some phase of road construction or maintenance or financing or administration. Each sheet has had its appended list of questions to be answered and returned to department headquarters. Thus it was made sure that the employee had at least conned his lessons. To what degree the answers received can safely be used to appraise and rank employees is highly doubtful. Service in the practical work of building and keeping up roads has rather to be measured by actual performance. There is, however, the certainty that some way has been made in inculcating a habit of reading and study.

That the correspondence course misses some of the benefits of personal contact, which the annual assembly in a road school gives to widely separated and often isolated workers is indisputable. On the other hand it escapes the danger of cramming so much instruction into a short period that it is only partially assimilated. Perhaps the ideal procedure would be to combine the two methods, employing the meeting for directed discussion to clarify questions not fully or clearly understood.

In a decade the winter road school has become a distinctive institution of American highway administration. Perhaps no other device could have satisfied the requirements of the situation as well and as quickly. The inauguration of correspondence instruction is, therefore, an occasion which deserves consideration.

Higher Demands of Cities

FROM the brief record of the controversy between the Owens Valley ranchers and the city of Los Angeles, given on another page of this issue, it is evident that these farmers, and the merchants who followed them to the valley, are worse off than the ordinary irrigation farmer in the West, who, as every one knows, is in bad case enough. The Owens Valley people, however, have had added to the ordinary hazards of irrigation development the "superior rights" of a powerful community reaching out farther and farther into the hills to find that basic necessity—water. The records of the controversy in the last year or two, with such spectacular performances as blowing up an aqueduct and cutting off canals, are none too clear. Hotheadedness is evident on both sides and cool judgment none too evident. The indications are, however, that the ranchers have just complaint in the tardiness of the compensation for damage done them while the city sits secure in its legal right to the waters of the valley.

The city doubtless will pay such damages as are legally required, but the difficulty is that they will probably accrue only to those who have property rights in the water and will not pass down to those satellites who ventured life and capital to supply the needs of the farm communities. Such men, in common with the adventurer into irrigation farming itself, realize that they are in a hazardous business, but it could hardly be said that they took this particular hazard when they set up in business in the Owens Valley. These men are bound to be victims of the social and legal development that apparently fosters a great urban growth.

The whole matter, indeed, aside from its local significance and its complications due to faulty negotiations, is a part of the dangerous magnification of the city. Different states have different basic laws regarding running water, but everywhere a city water supply is interpreted as "higher use." By that interpretation the city can exercise superior rights even when the water in the city is, as it is in Los Angeles, diverted to some other use than the personal or industrial service of the residents. For instance, a year ago, the Owens

Valley people were being deprived of water needed on their farms so that Los Angeles could get more water, a large part of which was being diverted to the San Fernando Valley for irrigation in the immediate outskirts of the city of Los Angeles.

Here is a nice question for judicial interpretation. How far can the cities go in depriving original owners of water rights in building up unnecessarily large urban areas? Our cities are growing too fast. They are forcing unsafe and unhealthful congestion. They house too many people. Is our law of "higher use" of water to be encouraging of this dangerous growth or is it to recognize that after all only a few realty owners and those who promote the purchase of realty profit by the tremendous and unnecessary growth of our cities and that the higher good of the community may lie in denying the city the right to grow rather than in encouraging it?

Just what is the higher good? To crowd more and more people into the mælstrom that is Los Angeles, or to encourage some producers of food and raiment to settle on the Owens Valley slopes? The question has large social significance—and our expounders of the law cannot always continue to ignore it.

Only last week the President, speaking to some automobile men in Washington, posed the same problem—though not in its relation to Los Angeles and its water supply, which after all is only an example of a trend and not a major instance of iniquity. "Some recent studies by engineers and sociologists," said the President, "have led to doubts whether the superior efficiency of the very great cities as business, industrial and cultural centers can be taken altogether for granted. They have advantages, but they also have disadvantages; and the disadvantages seem to be multiplying fastest. I do not presume to judge between those investigators who conclude that the cities must inevitably go on with their rapid rate of growth, and those others who tell us that transportation and industrial programs must be made to counteract this tendency and bring diffusion of the population masses. But it must be apparent that whichever view is correct, many and difficult and costly readjustments must be made. There is need for concerted, fundamental and courageous consideration of all the questions involved. They reach a hundred times deeper than the mere superficial problem of getting streams of motor cars moved through city streets. They have to do with the elementals of social organization. They concern vital phases of community welfare and progress."

This is an emphatic, but true, statement of the situation. Los Angeles with its urge for rise toward the head of the population lists; the fifty-odd story university for the University of Pittsburgh; the square mile or so of hospital buildings, projected for the medical center in uptown New York; skyscrapers in Tulsa and subways in Cleveland—all are straws in the wind. Get more people to our cities.

What are we going to do about it? Follow a *laisser faire* policy? Wait for it to cure itself, just as a group of small flies in an enclosed space will multiply according to a predictable curve which rises first but then falls through some natural law of faulty reproduction under adverse conditions? Or shall we attempt by man-made law to restrict city growth to some norm which more nearly conforms with man's capacity to control his surroundings? These are things that men—and judges—need to think on. They go deeper, as the President says, than the temporary water necessities of one metropolis, or the street congestion on a fashionable boulevard, or the esthetic impress of an additional skyscraper. They are the bases of our coming civilization.

Forging Ahead

DOMINANT at the convention of the American Water Works Convention at Louisville last week was the work of the Standardization Council, both in committee and on the convention floor. In fact, in the entire five years since this council was started it has dominated the technical work of the association. The output of the council and its many sub-committees soon ran beyond the capacity of the *Journal*. Much of this output, after having been worked over and over for improvement in content and form, will soon appear in a Manual of Water Works Practice, a large book setting forth the best judgment of the water-works fraternity of the country as to workable ideals in the fifty or more fields which will be covered. To this end civil, mechanical and sanitary engineers, chemists, bacteriologists, superintendents and other operating officials have cooperated. This has been done under the able and unflagging leadership of the chairman of the council, assisted by his fellow councillors and by the chairman and members of some twenty sub-committees. Few organizations can show such an achievement in so short a time.

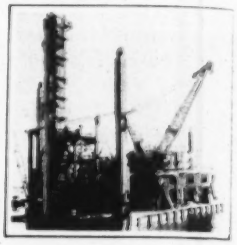
Although the work so well begun is of necessity a continuing one it has been decided to let up materially on the drive of the initial five years and particularly of some months past. This is wise. To go on at such a pace would be suicidal, justifiable as has been the drive thus far. Energy needs to be expended in other directions and the convention programs and the *Journal* need to take on new shapes and colors to meet other needs of the association.

Not that the association has been marking time elsewhere. It has grown rapidly in numbers, and in financial strength. Its geographical and sessional divisions and its growing co-operation with other organizations have added greatly to its usefulness. Besides the state and regional divisions there are now divisions concerned with water treatment, plant operation and fire protection.

Of great future promise was the decision of the new executive committee to employ as secretary a man well fitted by experience in water-works operation and in the management of the association, and equally fitted by temperament and social qualities, and well known to the rank and file of the association. This is Beekman C. Little, superintendent of the water-works of Rochester, N. Y., and recently president of the association. With freedom from the office details performed by the assistant to the secretary it is expected that Mr. Little will be free to make valuable contacts with the members and the divisions of the association. His continuation in the Rochester superintendency will keep him in close touch with the practical operation of water-works.

Under such favorable auspices as have been outlined and with the leadership of the new president and the other officers, the American Water Works Association may be expected to continue to forge ahead.

Making and Driving 110-Ft. Concrete Piles at Manila



Manufacture and Placing of Footing Piles for New Shipping Pier at Philippine Major Port—Huge Piledriver Especially Built for this Purpose

By E. C. Earle
Chief Designing and Port Works Engineer, Bureau of Public Works, and Vice-President Manila Harbor Board, Manila, P. I.

This is the second of two articles by Mr. Earle on the large new shipping pier at Manila; the first article on the pier itself appeared in the issue of April 30, 1925.—Editor.

Pier 7 of the Port of Manila, as described in the earlier article, is a reinforced-concrete and steel-frame structure carried on straight and battered reinforced-concrete piles, 24x24 in. in section and 110 ft. long. The casting of these piles and their placing by a specially designed piledriver is the subject of this article.

Fig. 1 illustrates the general layout of the pile field, storage yards, sheds, shop, provisional wharf and launching ways. A 16-ton derrick was erected on the south end of the wharf and two elevated material bins of 200 yd. capacity were put up adjacent to the wharf and within reach of the derrick boom. Sand and crushed rock was handled from scows to the bins by a 1½-yd. grab bucket and this aggregate was moved in dump cars to large storage piles, situated to the rear of the head tower of the cableway pile-casting plant, by means of an elevated track which passed under the two bins.

The pile field was so laid out as to permit casting the piles with an aerial cableway and moving them from the field to the pile barge with a locomotive crane operating over a ladder track. The entire field accommodated 1,584 piles of various lengths.

Various methods of casting the piles were studied with a view to assuring the deposit of well mixed batches of dense concrete in the pile forms. The cableway type of plant best suited local conditions and was built. A pair of standard-gage tracks were put down at each end of the pile field approximately 550 ft. apart. Over each pair of tracks a timber tower was mounted on six standard railway trucks. Both towers were weighted with heavy concrete blocks forming the anchorage for the track cable. A 1½-in. track cable was suspended between the two towers and carried a steel carriage (hauled by an endless cable) from which a bottom-dump bucket for concreting was suspended. Mixers were centrally mounted on the head tower platform. This tower also carried the hoisting and haulage machinery consisting of a double-drum hoisting engine and swinging gear, the latter rigged to drive the haulage line. One drum was used for hoisting the filled buckets to the latching carriage hook and the second drum for hoisting the aggregate to the hopper, while the shaft of the swinging gear was fitted with a large improvised driving pulley which drove the endless haulage line. The tail tower carried a two ton floating counterweight to maintain the proper tension in the endless haulage cable.

The 1:½:3 mixture used in the piles was well graded, thoroughly mixed and unusually well placed. Tests showed the concrete to be dense and strong, cubes breaking at average values of 3,600 to 5,300 lb. per sq.in. after seasoning 28 to 40 days. Approximately 230 yd. of concrete were handled daily with the plant when operating to capacity, 14 piles being cast.

The use of this type of plant instead of a spouting plant made it possible to deposit the aggregate in almost the same state as it left the mixer, at the same time leaving the area occupied by the pile forms entirely clear of platforms and other obstructions.

Pile Makeup—The piles are reinforced with eight 1-in. deformed bars with center of steel 2½ in. from the surface. Hoops of ¼-in. rods were used with a spacing of 1½ in. at head of pile for a distance of 3 ft., then 3, 6 and 9 in. centerings over a distance of 1, 2 and 3 ft. Twelve-inch spacing was satisfactory for the rest of the length of the pile except near the point of the pile where the hoops were spaced on 3-in. centers for a distance of 3 ft. All bars were allowed to project 3 ft. above the head of the pile for the purpose of rigidly connecting the deck girders to the pile, while at the points the bars were bent inward to better reinforce that part. A 1½-in. rod, bent in the shape of a hairpin, was set in the head of each pile to receive the shackle of the pile line used in suspending the pile in the leads of the driver. Cambered piles were cast for use as batter or brace piles and were reinforced as noted for the straight piles except considerably heavier in the plane of camber. The camber in the longest batter pile amounted to approximately 5½ inches.

Fabrication of Reinforcement — The reinforcement units for the piles were fabricated under cover in the makeup shed in sets of three. When a set of three units was completed the bridge timbers were swung down; racks pushed back and the units moved out on to the storage supports whence the locomotive crane removed them to the field for storage until needed or set them into pile forms. Nine units were fabricated daily, working a 9-hour shift.

Handling Piles from Field to Barge—Piles seasoned 60 days or longer are removed from the field to the pile barge, when needed, by a 50-ton locomotive crane mounted on specified 10-ft. gage trucks. The lifting rig which is suspended from the crane boom was designed especially to avoid inducing severe stresses in the piles. Essentially the rig consists of a long upper spreading strut of latticed structural steel, spreading two flat woven wire cables which hang from the crane hook. A pair of equalizing sheaves located near each end of this strut carry a pair of cables which support the two shorter latticed struts below. To each of the two lower struts are attached a pair of hinged steel pendants and a bottom bar. When piles are to be removed the rig is lowered over the pile and the arms of the pendants are raised on the near or open side of the pile while the

bottom bars are inserted through tin covered slots left in the forms for this purpose.

Mammoth Pile Driver—The successful handling and driving of these extra large piles, which are of record

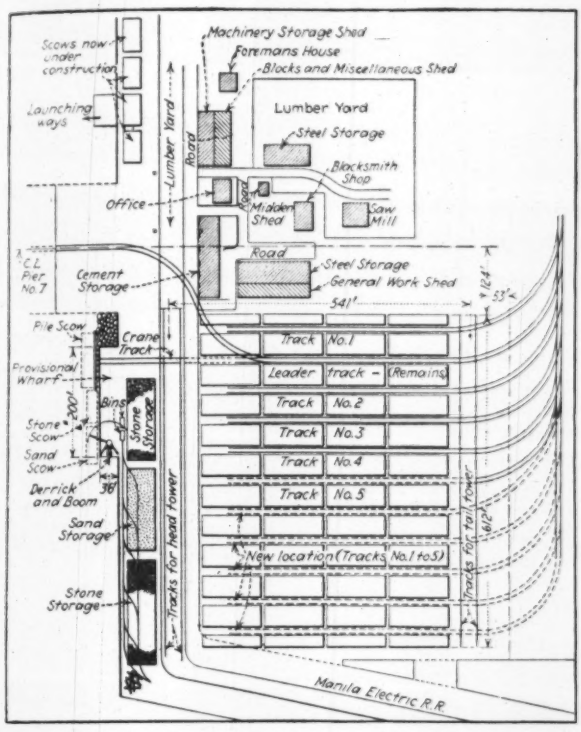


FIG. 1—GENERAL LAYOUT OF PILE FIELD

size—110 ft. long by 24 in. square—and which weigh 64,000 lb., required the construction of what is perhaps the largest and most powerful floating piledriver ever built, of a type especially adapted to the needs of the project, equipped with long steel movable leads; a powerful steam hammer; a pair of 40-ton steel derricks with 60-ft. booms; powerful hoisting engines; a battery of both steam and electric high pressure jet pumps, and much other machinery required for the efficient functioning of the driver.

To obtain ample stability under all conditions of operation and to provide sufficient space for the installation of all machinery, a staunch wooden hull 110 ft. long, 55 ft. wide, with a depth forward of 15 ft. 6 in. and 7 ft. 6 in. by the stern, was designed to float with a freeboard of about 5 ft. with deck level, displacement approximately 1,200 tons.

General Arrangement of Driver — The main machinery is carried on the several levels of the leader carriage which is centrally located at the extreme forward end of the driver. All other machinery and plant is fixed to or founded on the main deck with the exception of the port and starboard derrick engines carried on the upper deck and the capstan engines below deck. The boiler room, situated on the after part of the main deck, houses the power plant and the forward spud engines. Boiler feed-water tanks of ample capacity were built into the hull below deck. An 8x8-in. double-cylinder compound-geared anchor windlass with two gypsies is fixed to the deck at the stern end of the driver aft of the boiler room, and carries two 5,000-lb. anchors.

Open deck space running fore and aft on both sides of the boiler room is utilized for deck fittings such as line spools, mooring bits, steam and dummy capstans for the handling of lines when maneuvering. Two steel derricks of 40 tons capacity are bracketed to the forward corners of the driver. Living quarters for the driver superintendent and engineman are provided on the aft part of the upper deck. The crew are provided with folding bunks and lockers in the boiler room.

Ponderous Spuds—For the purpose of adequately anchoring the hull in position when driving and to further stabilize the driver during all operations, by pinning up, the hull was equipped forward with two ponderous spuds, each 36 in. square and 96 ft. in length, weighing approximately 20 tons each, while aft a single spud 24 in. square and of the same length was provided to hold the driver against swinging. The forward spuds were made up from 20x20-in. timbers, securely fastened with clinch bolts. All spuds were equipped with cast steel shoes, slightly tapered; those for the forward spuds weighing approximately 6,000 lb. each. The top of each forward spud carried a 42-in. cast-steel sheave, and a similar sheave, housed, was fitted in each spud just above the shoe.

Heavy timbers bolted to the sides of the hull form the spud wells and guides. An upper spud keeper and a lower spud gate of cast steel are fastened across the outer face of each pair of spud guides.

Operation and Rigging of Spuds—The raising or lowering of either of the forward spuds is accomplished

FIG. 2—VIEW OF THE PILE FIELD, MANILA PIER PILE CONSTRUCTION

at the will of the leverman on the operating bridge, through lever controls governing separate 8½x8-in. double-cylinder reversible spud engines. The spud cables used are 1¾-in. diameter plough steel, 6x37 construction, with steel centers. One end of both upper and lower spud cable is clipped to the spud engine drum. The cable leading from the underside is carried forward through the hull, below deck, and up through the deck at the spud, over an idler sheave and down under the lower sheave housed in the spud, then up to the second set of adjusting bolts. A "pin up" of the forward end of the driver of about 16 in. is possible with this equipment.

As the stern spud is used only to prevent swinging, it is not equipped with a top sheave. The rigging for raising this spud is similar to that for the forward spuds but lighter; however, no separate spud engine

is used, the 1¼-in. cable attached to this spud being carried forward through the hull below deck whence it is trained to a drum driven by the main engine, situated on the second level of the leader carriage.

Leader Carriage — A heavy carriage of structural steel, upon which is mounted the main machinery including the carriage propelling mechanism also carries the steel leads, the tipping (screw) engine and a battery of steam- and electric-driven jet pumps. It is designed to move fore-and-aft on rollers through a distance of 7½ ft. Essentially it is made up of a pair of steel box girders, stiffened and braced with cross frames; a pair of longitudinal trussed frames riveted to the after ends of the girders and a four-post steel

FIG. 3—CABLEWAY BUCKET DISCHARGING INTO BUGGY IN PILE FABRICATION

superstructure supported on the girders. The forward portion of the carriage rests on two nests of six 8-in. steel rollers, which in turn bear on and move in a pair of steel track channels bolted to bolster timbers over the center bulkheads of the hull. The after portion rests and slides on two planed slide bearings.

All steam jet pumps and part of the electric jet pumps are mounted on the lower level of the carriage about 2½ ft. above deck, while the main engine and drums are carried at the rear of the carriage on heavy crossbeams at the second level approximately 11 ft. 5 in. above deck. The tipping engine is also on this level, but forward. The operating platform occupies the third level, 27 ft. above deck, and it is here that all lever and other principal controls are centered. The fourth level, 34 ft. above deck, carrying two pairs of crossbeams at the rear which house the pile and hammer line guard sheaves, is roofed to afford protection to the leverman on the operating platform below.

A heavy transverse girder rests on and is secured to the forward end of the carriage about 11½ ft. above deck and carries the lower pintle which receives no weight from the leads; its function is to transmit motion in a transverse direction to the leads and to permit their swiveling. A second transverse girder is secured to the front columns of the upper carriage frame, 34 ft. above deck, directly over the lower girder, and carries the upper pintle bearing which in turn supports the entire weight of the leads, hammer and pile. Propulsion of the carriage is effected by means of a rack and pinion driven by the main engine; the rack being securely fastened to the deck.

Leads—The steel leads, especially designed to move transversely across the face of the leader carriage or to swivel about the upper pintle bearing for driving batter piles, are 93½ ft. long from top of pile sheave to water line and of U form in cross-section, measuring 6 ft. 3 in. across the open face and 4 ft. 9 in. in depth. Structurally, the leads consist of a number of heavy cast-steel yokes spaced 6 to 8 ft. apart, plated up on both sides, open in front, stiffened with angles in each corner and heavy diagonal bracing in the back, except at both extremities where solid back plating was used, and at the upper pintle where a heavy plate diaphragm extends the full distance between yokes. The top of the leads is capped with beams and plates arranged to support the large pile line and hammer line sheaves on bracketed bearings. A track for guiding the steam hammer, made up of Z bars, extends the full length of the leads on both sides. Near the top of the leads the track slopes away toward the rear and permits the hammer to enter the leads completely, thus presenting a clean and unobstructed face to piles turned up across the frame. An automatic hammer locking device locks the hammer after it has entered the leads.

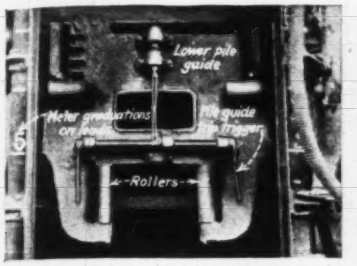
Suspended within the leads is the movable upper pile guide which can be held at any desired elevation. During the process of turning a pile up and into the leads, both upper and lower pile guides remain in a collapsed or turned down position. After the pile has been suspended in the leads, both guides are turned out to give support to the pile and the fingers of the upper guide are then laid over to prevent the pile from falling outward. The lower guide, which is stationary, is hung within the leads at a fixed elevation.

Machinery—Movement of the leads is accomplished by lever controls governing the single 8½x8-in. double cylinder reversible tipping engine, located on the second level of the leader carriage, which drives both the upper screw shaft operating on the upper pintle bearing and the lower shaft connected with the lower pintle. The simultaneous operation of both upper and lower screw shaft produces a transverse movement of the leads while the operation of either upper or lower screw shaft, independently, swivels the leads about the upper pintle. The leads may be moved while in a vertical position from one side of the carriage to the other through a distance of 9 ft. or may be brought to a 1:3 batter and then similarly moved in either direction.

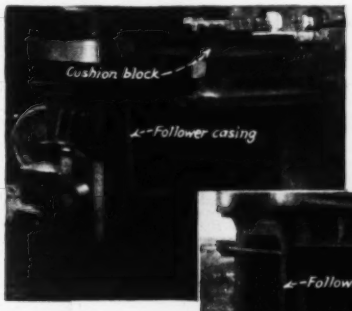
The main machinery, consisting of the pile hoist, hammer hoist, stern spud hoist and pile guide drum, is located on the second level of the leader carriage and is driven by a single 12x16-in. double-cylinder reversible engine.

All principal motions of the driver are controlled from the operating platform. From this platform the leverman commands a good view of the work and is in an excellent position at all times to see the signals made by the superintendent on the pier deck. Twenty-five lines of control originate here, the most important ones

Details of Piledriver "Mammoth" Used in Driving 110-Ft. Concrete Piles at Manila



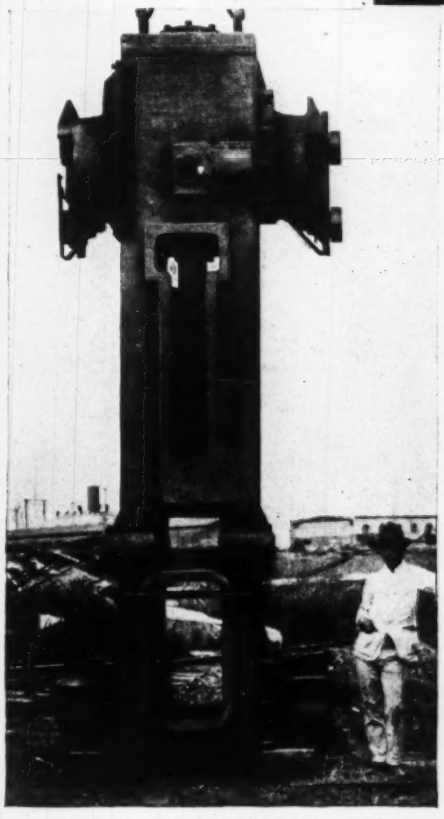
LOWER PILE GUIDE (COLLAPSED)



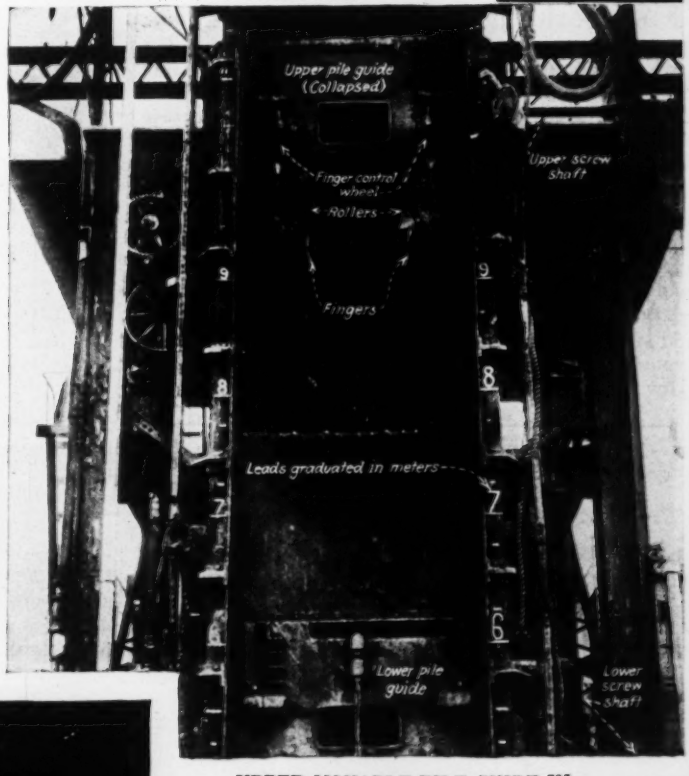
FOLLOWER, CASING AND CUSHION BLOCK (LEFT)

FORWARD SPUD AND TOP SHEAVE (RIGHT)

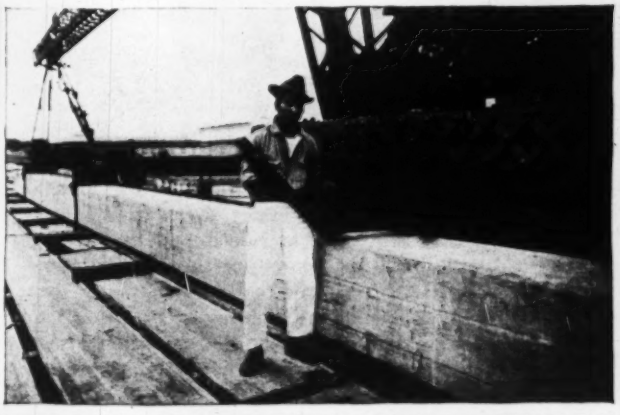
ROLLER GUIDE ATTACHED TO FOLLOWER



STEAM HAMMER—FRONT VIEW



UPPER MOVABLE PILE GUIDE IN COLLAPSED POSITION



HUGE PENDANT AND BOTTOM BAR, PART OF LIFTING RIG FOR MOVING 110-FT. CONCRETE PILES

BOILER ROOM DURING CONSTRUCTION SHOWING SPUD ENGINES AND BOILER

being centered in or near the lever stand facing the leads.

With the exception of the battery of six electric jet pumps, all machinery is operated with steam furnished from a 76-in.x18-ft. locomotive type boiler—A.S.M.E. standard—under a pressure of 150 pounds.

A small vertical standby high pressure boiler has been installed for use in case of an emergency, to raise or lower spuds and to operate the anchor windlass. Power for the operation of the electric-driven jet pumps on the driver is brought from shore at 3,300 volts and stepped down to 250 volts for operation.

Large Special Steam Hammer Used—The big hammer used to drive the piles was especially constructed for this project, and has several features of importance, principal of which is the safety device for preventing the ram from operating unless the hammer has been fully seated upon the pile to be driven. The hammer, including follower casing, stands 17 ft. in height, measures 36 in. across its face and 26 in. in depth, and weighs with follower approximately 30,000 pounds. The main body is cast iron and contains the cylinder, valve chest and ram guides. The cylinder is of 14-in. bore and 36-in. stroke and operates a 4,000-lb. ram. The piston is double acting and with an effective steam pressure of 80 lb. the hammer develops approximately 4,000,000 ft.lb. of work per minute, striking at the rate of 85 blows.

The follower is of cast steel and is designed to fit over the hairpin and reinforcing rods which project above the head of the pile. A spiked wood cushion block of native hardwood, known as mountain dungon, which is very tough and fibrous and which is banded with ½-in. flat steel 4 in. wide and 18 ft. long, wrapped three times around and riveted with countersunk rivets closely spaced, fits on top of the follower and receives the direct blows of the hammer. Cushion blocks last on the average for the driving of six piles. Where the driving has been very hard some blocks have given out after driving a single pile.

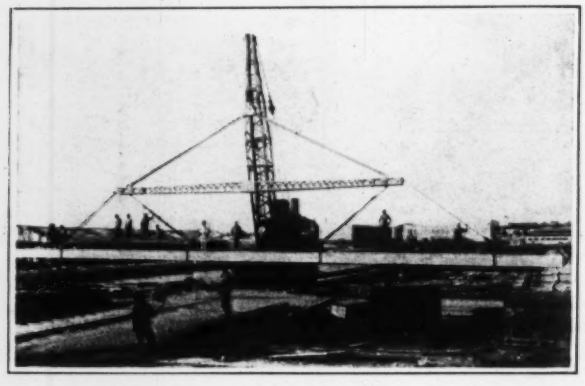


FIG. 4—HANDLING A 24x24-IN. BY 110-FT. CONCRETE PILE AT MANILA PIER

A pair of roller guide brackets are attached to the upper part of the hammer body and to the follower casing, and travel in the hammer track of the leads, thus permitting the accurate location of the hammer over the pile.

High-Pressure Jets—A battery of two single-stage 50-lb., 2-stage 100-lb. and two 4-stage 200-lb. centrif- 50-lb., two 2-stage 100-lb. and two 4-stage 200-lb. centrif- three pumps each connected in series, and supply water at the rate of 500 gal. per min. under a pressure of 350 lb. to all of the three jet lines. Each pump is bypassed to enable the use of any two in case of a shut-down of a third.

Derricks and Derrick Engines—A 40-ton stiff-leg derrick is bracketed to each of the forward corners of the hull for handling piles up to 80 ft. in length without the use of a stiffening or equalizing device and for handling piles above this length with a stiffening beam.

Driving Progress—A maximum of 8 piles per 10-hr. day was driven. This number could be increased to 12, using the stiffening beam lifting rig for up-ending the piles, but the use of the beam method is limited to perfectly calm weather.

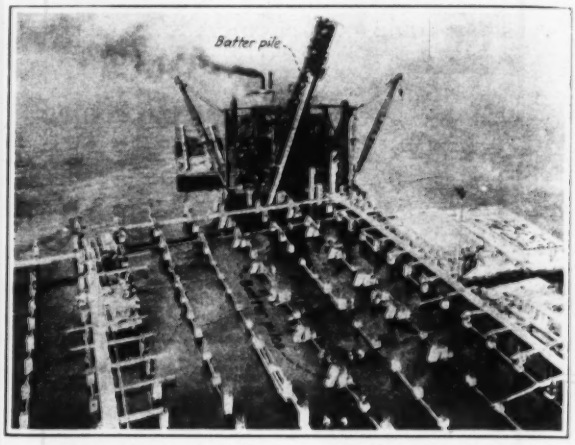


FIG. 5—GENERAL VIEW OF PILES BEING DRIVEN BY MONSTER PILEDRIVER
Batter piles are clearly shown

To ascertain the condition of piles driven at various locations over the pier site where a variation in material was encountered in driving, a number of piles were pulled and carefully examined, not only at the point but throughout the length of the pile. The examination revealed no damage whatsoever and indicated that the method of driving was satisfactory.

Test of Bearing Power of Piles—As the depth of hard material varied considerably, a test load of 200 tons was applied to a few piles whenever a considerable amount of variation in penetration occurred. To avoid delaying the progress of the driver, special testing apparatus that could be quickly moved from one location to another was built.

This apparatus consists of a testing beam of structural steel, a hollow steel cylinder to set on the pile and two test barges. Heavy timber and longitudinal wales are bolted against the pile selected for test and six others in line, about 4 ft. below zero tide. The steel cylinder is then placed over the protruding bars of the pile and is filled with dry sand. A rectangular wooden cap of hardwood, cylindrical in form on the underside, is placed on top of the cylinder so as to bear on the sand and the test beam is raised and seated on the wooden cap. Both test scows are then floated in place, one on each side of the pile to be tested. This done, a cable is reaved around the sheaves in the cross-frames located on the scows and over the sheaves in the test beam directly above, thence to the engine drums. The scows are then raised so as to be clear of the highest tide and are loaded with water and steel.

Under the maximum loading these piles are driven

to support, and an apparent settlement of 11 mm. (about ½ in.) occurred, part of which was deformation. Under an additional loading of 100 tons a further settlement of 11 mm. was recorded. Upon removal of all load, after the lapse of 15 days, a recovery of 8½ mm. (about ⅜ in.) was noted. Had the pile not been loaded beyond 100 tons the net settlement realized would probably have amounted to 3½ mm. or approximately ⅛ inch.

Personnel—The pier was constructed by the Insular Government of the Philippine Islands by the Bureau of Public Works, under the supervision of the writer.

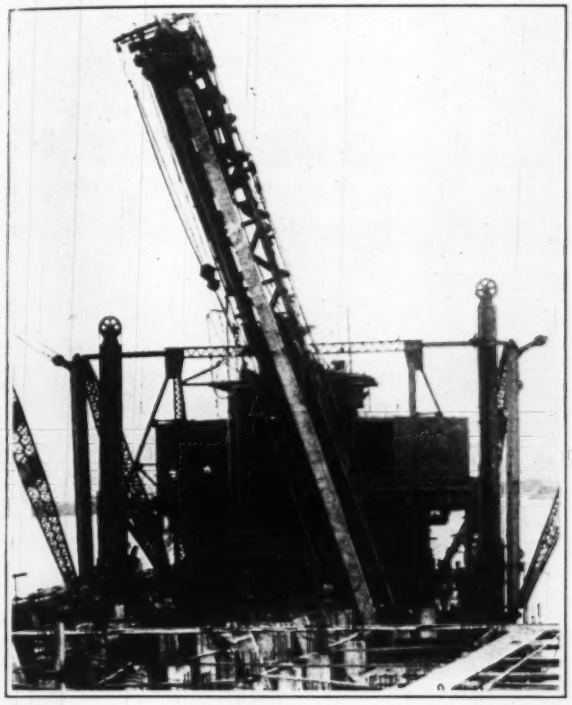


FIG. 6—PILEDRIVER "MAMMOTH," MANILA PIER
110-ft. reinforced-concrete pile in the lead.

The machinery on the driver was manufactured by several concerns. All of the principal machinery and structural parts were built by the Bucyrus Co., of Milwaukee, Wis., while the special steam hammer was made by the Union Iron Works of Hoboken, N. J. The derrick and anchor windlass were fabricated by the American Hoist and Derrick Co.

Time Required for Bids

A schedule of minimum time in working days for estimating building work and preparing bids has been worked out by a committee of the Southern California Chapter of the Associated General Contractors. It covers eight classes of buildings at seven price ranges:

	Class of Structure	To $25,000	$25,000 to $50,000	$50,000 to $100,000	$100,000 to $200,000	$200,000 to $400,000	$400,000 to $700,000	Over $700,000
A	Theatres, large schools, clubs, hospitals, banks, churches	8	10	12	14	16	22	30
A	Hotels, office buildings, apartments	7	8	10	12	14	18	24
A	Factory and loft buildings, warehouses	7	8	9	10	11	16	20
C	Theatres, schools, churches, clubs, banks, hospitals	8	9	10	11	12	18	..
C	Apartments, flats, office buildings, stores	7	8	9	9	10	16	..
C	Warehouses, garage buildings, factories	7	7	7	8	8	..	..
D	Residences, flats	6	8 to 12	..	..	..	..	..
D	Sheds, warehouses	6	8 to 10	..	..	..	..	..

Pedestrians Move with Traffic at Los Angeles Intersections

TRAFFIC congestion in Los Angeles, which has given officials of that city so much concern, has been relieved somewhat by the strict enforcement of an ordinance requiring pedestrians to cross streets in the business district only at crossings and there only in the direction of traffic. To enforce this law several traffic officers have been required at each busy crossing, and it has been necessary literally to educate the public to new habits.

Each change of traffic signals, which are of the semaphore type, is announced by a bell. Five seconds are allowed for vehicles in the intersection to get clear before vehicles waiting on the intersecting street are allowed to enter the intersection. After the ringing of the first bell no more traffic (either vehicles or pedestrians) may enter the intersection in the line of traffic that is being stopped. Waiting pedestrians in the cross traffic, however, do not have to observe the five-second delay imposed on waiting vehicles, and when the stop-bell rings the waiting throng of cross-traffic pedestrians plunges into the street taking whatever chances it must with the last few vehicles coming out of the intersection. This five-second start given to the pedestrians going in the direction of traffic which is given the right-of-way after the ringing of the bell usually permits most of them to reach the middle of the street and thus gives the cars, when they start, nearly unobstructed passage.

The accompanying picture was taken just at the instant of sounding the bell marking the end of a five-second interval. The automobile in the foreground has just started (under authority of the semaphore seen just above it), but the pedestrians who had been waiting to go in the same direction, having a five-second start, had by this time gotten well into the middle of the street. The young lady offender in the foreground, having crossed in the forbidden period is made to go back even through traffic, and await the proper signal.

CONTROLLING PEDESTRIAN TRAFFIC IN LOS ANGELES

The control of pedestrians by semaphore went into effect January 24, and the month of February showed, according to police department records, a material reduction of pedestrian accidents in the business district. The average daily pedestrian accidents in January was 4.16; in February it was only 3.43, a reduction of 17 per cent.

Low-Head Power Plant Designed for Typical Mid-West River

Pinhook Hydro-Electric Plant in Iowa—Earth Dike Without Corewall—Spillway and Power House on Piles

By E. L. Chandler
Price Brothers Co., Dayton, Ohio

IOWA is not to be ranked among the greater power-producing states, yet she is setting an example in the utilization of her resources that is worthy of notice. There are more than fifty developments in the state, and, including Keokuk as an Iowa project, they total over 173,000 hp. of hydro-electric service, with some 3,000 hp. devoted to other purposes. Aside from Keokuk, the outstanding project of the middle west, none of the plants is large, the total development being about 18,600 hp. This is scattered throughout the state in capacities ranging from less than 100 hp. up to one of 1,800 hp. The latter, the Pinhook plant, near Maquoketa on the Maquoketa River, completed in 1924, is the latest addition.

Toward the southwest Iowa merges into the prairies, and little is to be found in the way of power sites. Greater fall is to be found in the streams of the east, and particularly the northeast. That portion of the state is a part of the "driftless area" which was little disturbed by glacial action and is, therefore, more rugged in its topography than the glaciated regions.

The Maquoketa River, with a watershed of about 1,000 square miles above the Pinhook plant, empties into the Mississippi about midway between the north and south boundaries of the state. The Pinhook plant, of which Fig. 1 is a general view with the water about 3 ft. below spillway level, is situated 30 miles from the mouth of the river. The picture was taken looking upstream from the top of a bluff on the south side of the valley. Although the topography is more rugged a few miles to the north, this view is quite typical of the country. The outcropping ledge rock is Niagara limestone, which is to be found along each side of the valley, but which drops to an unknown depth below the bed of the river in the vicinity of the dam.

Earth and Concrete Dam—The dam consists of a compacted earth dike, about 20 ft. high, extending from the north bank of the river about 450 ft. north to the hills on that side of the valley, a concrete spillway section 157 ft. 6 in. long, and the power house structure, 30x60 ft., abutting the south bank. See Figs. 1 and 2.

Material for the embankment was obtained in part from necessary river excavation and in part from borrow pits. Nearly all of it was hauled to place by teams, both wagons and scrapers being used. No center core was built, but for the upstream half of the embankment, carefully selected impervious soil was required. Owing to the nature of the soil available, it was found that an extremely tight result was obtained with no other compacting than the travel of the teams during construction. The downstream half is pervious sand and gravel, to afford drainage. To further facilitate drainage, a system of tile drains was laid under the downstream half leading to a ditch paralleling the downstream toe. The material was deposited in 9- to 12-in. layers, and in construction, care was taken to have the layers of soil overlap the layers of sand and gravel sufficiently to avoid a plane of cleavage between the two. The top width of this part of the dam is 8 ft., the upstream slope is 2½ to 1, and the downstream slope 2 to 1. There is a 5-ft. freeboard and the upstream slope is riprapped for 10 ft. below the top.

The abutment wall which retains the embankment is a counterforted, reinforced-concrete wall. See Fig. 2. The counterforts, extending into the embankment, serve as cutoffs to check seepage along the back of the wall. Following up the top of the land side of the wall is a fishway. A shaft to provide ventilation for and access to the inside of the hollow spillway is also incorporated in the wall.

Spillway—The spillway is divided into six bays, each one fitted with a tainter gate. To make it possible to draw down the reservoir level, and to give an added factor of safety in case of extreme flood, the crest of

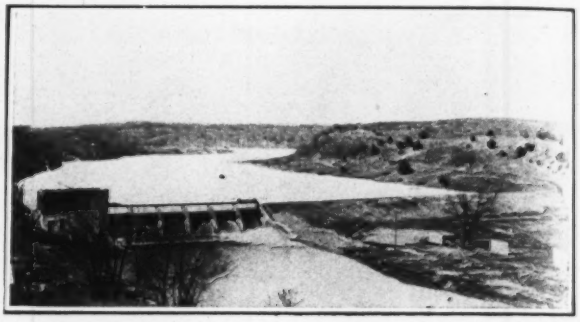


FIG. 1—PINHOOK DAM AND SPILLWAY, MAQUOKETA RIVER, IOWA

bay 1, next to the power house, is 5 ft. lower than the others. The gate for bay 1 is, correspondingly, 5 ft. higher than the others in order to obtain a uniform level for the tops of the gates. The large gate is operated by a fixed, hand operated hoist, while for the others a movable, electrically operated hoist is provided.

Fig. 3 gives a typical cross-section of the spillway from bays 2 to 6, the structure being of the hollow, reinforced-concrete type. The five main piers are 30 in. thick, and, in the center of each bay, a smaller pier, under the deck, serves as a support for it. In the river bed the material has a preponderance of fairly well graded sand, although there is considerable gravel and occasional boulders as large as ¼ cu.yd. Therefore, the concrete structures are all founded on timber piles from 20 to 30 ft. long. Generally speaking, those piles under the spillway piers and the upstream half of the abutment wall and the power house, are 30 ft. long, shorter lengths being used further downstream. Along the upstream edge of the spillway and power house, a steel sheetpile cutoff was driven to a depth of 30 ft.

The weir, shown in Figs. 2 and 3, creates a pool during times of spillway discharge which serves as a cushion for the overflow and helps to dissipate the velocity of the current. It is pierced by openings for the purpose of draining the pool during periods when there is no flow over the spillway.

A feature of the design is the use of flexible aprons. For the spillway, the apron is composed of one row of reinforced-concrete slabs, 32x34 ft., adjoining the weir, and three rows of slabs, each 17 ft. square, extending downstream from the row of larger slabs. Each block is heavily reinforced in both directions and is hinged

to its neighbors so that the whole is a somewhat flexible structure. For the tail race, two rows of the smaller blocks were constructed instead of three as in the case of the spillway.

Power House—In Fig. 3 is a section through the

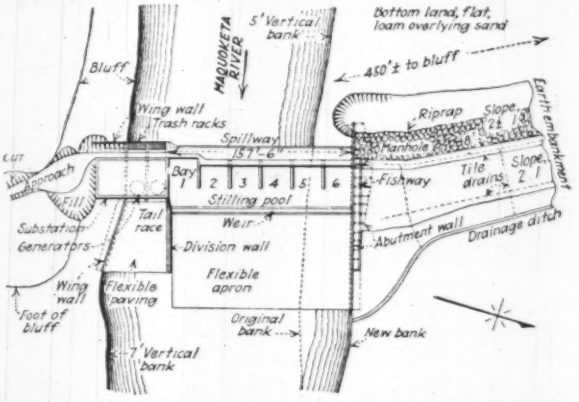


FIG. 2—GENERAL PLAN OF PINHOOK DEVELOPMENT

power house and tail race, showing the general arrangement of the installation. There are two units, each composed of a 39-in., vertical turbine, direct-connected to a 750-kva., 3-phase, 60-cycle generator. Incorporated in the power house structure there is also a distributing sub-station.

Upstream from the draft tube block, the footings for the side walls of the power house proper and for the wall separating the two units are arranged in steps as shown in Fig. 3. This is for the sake of economy in construction, in building from the foundation of the draft tube block up to the level of the spillway footings. The footing for the south wall is 4 ft. 6 in. wide, that for the middle wall is 7 ft. wide and for the north one is 5 ft. 6 in. wide. As shown in section,

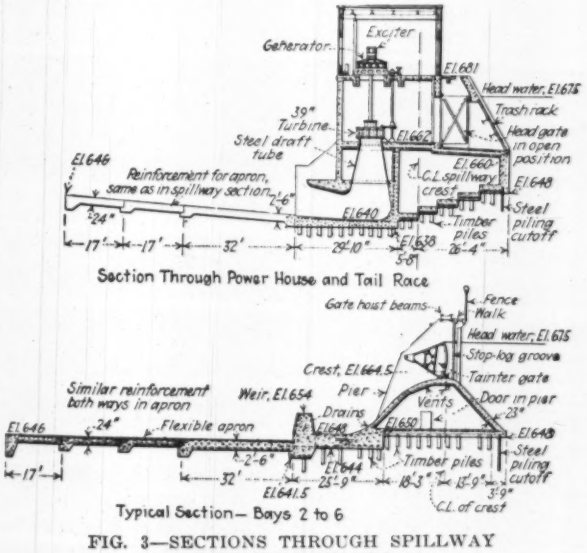


FIG. 3—SECTIONS THROUGH SPILLWAY AND POWERHOUSE

the footings have the appearance of being composed of a series of separate blocks, but the entire footing, in each case, is so thoroughly reinforced and tied to the superimposed wall as to be a very substantial structure monolithic with the wall.

The southwest wing wall was carried back into the hillside to form a cutoff, backfill around the wall being of tight clay.

Other than the steel sheetpiling, no provision was made against uplift pressure under the concrete structures. The cutoff piling was deemed sufficient in view of the nature of the underlying material. Actual measurements of the upward pressure under the spillway with a head acting upon it justify the procedure.

The plant was designed for a speed of 180 r.p.m. and a normal operating head of 25 ft. Except for Keokuk this is the highest head yet developed in Iowa. It was expected that the average annual output of the plant would be 3,500,000 kw.-hr., but results already obtained indicate a considerably higher production.

The project was financed by the Eastern Iowa Power Co., a subsidiary of the Iowa Electric Co. Market for the output will be found through the system of the latter company which supplies both light and power for some eighty communities in the central and eastern portions of the state.

The plant was designed and the construction supervised by Holland, Ackerman and Holland, consulting engineers, Ann Arbor, Mich. It was built by Price Brothers Co., general contractors, Dayton, Ohio; work was started in May, 1923, and completed in January, 1924. All work was subject to the approval of J. D. Wardle, chief engineer for the Iowa Electric Co. The Fargo Engineering Co. acted as consulting engineers for the latter company.

High Temperatures Observed in Library Fire Test

UNEXPECTEDLY high temperatures were reached in a test fire planned to simulate a fire in a library, at the Bureau of Standards on April 3. The experiment was carried out in a small brick and concrete building, representing a single room, which had previously been used for fires representing those occurring in office occupancies. All the work is part of an investigation of the degree of fire exposure produced by different kinds of occupancy, and its results are expected to lead to better methods of rating the service value of fireproofing.

For the library test the room had been filled with papers in such a way as to simulate a record or library room. Discarded accounts and records from the Navy Department were stacked on shelves in the room, to a total amount of 58 lb. combustible material per square foot. The fire was started in a large cage filled with kindling wood and surrounded by a sheet-iron shield, the shield being opened when the wood was fully ignited, to let the fire and hot gases out into the room; this condition was similar to that obtaining when fire bursts into a room from an adjoining part of a building.

A maximum temperature of nearly 2,000 deg. F. was reached at the peak of the fire. The débris was still glowing or burning on the next afternoon, while in similar fire experiments with typical office occupancies the fire has usually been over in 2 hr. and the building has been cold on the following day. The effect of the library fire on the building also was more severe than that of previous fires. The edge of the roof was pulled up from the wall by warping, as much as 2½ in., and the walls were bulged out at the top by amounts up to 1 in.

Exhaust-and-Supply Ventilation of a Long Street Tunnel

Exhaust and Blower System of Liberty Tunnel, Pittsburgh, Designed for 100-Ft. Spacing of Vehicles and Supply of 2,500 Cu.ft. Fresh Air Per Minute Per Vehicle, With Overload Capacity for Emergencies

REGULAR operation of the Liberty tunnels, Pittsburgh, by the authorities of Allegheny County began on Sept. 1, 1924, following a month's trial operation of the ventilating plant by the contractor. For the previous seven months, when completion of the plant was delayed by jurisdictional strikes and other troubles, the tunnel had been operated without mechanical ventilation. During that time it performed well when traffic was small or moderate, but on one or two occasions gave trouble during hours of heavy traffic, when accident or blockade interrupted traffic. Observations made during this period by the Bureau of Mines were reported by Fieldner, Yant and Sadler in *Engineering News-Record* of Aug. 21, 1924, p. 290. As the Liberty tunnel is the longest motor-traffic tunnel in existence and is the first to furnish actual data on carbon monoxide dilution, the ventilating plant is briefly described in the following:

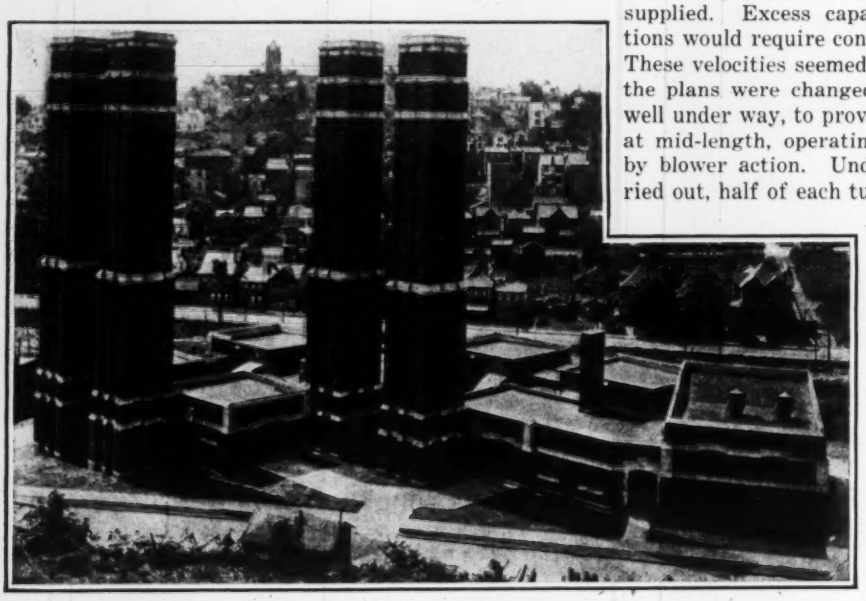


FIG. 1—FAN HOUSE, 20 FT. ABOVE LIBERTY TUNNELS
Plant includes four 100-ft. stacks and eight fans

The Liberty tunnel is 5,889 ft. long from portal to portal, and comprises two tubes, each 26 ft. wide at the floor and 20 ft. high, the roof being formed by a semicircular arch of 13 ft. 3½ in. radius. It is lined with concrete throughout. The roadway is 21 ft. wide between curbs, and there is a narrow footwalk on one side. The alignment is straight. The tunnel descends on a slight grade from the south or suburban end to the north or city end, which is halfway up the side of the bluff along the south bank of the Monongahela River. Each tube takes traffic in one direction only, and provides for two lines of traffic. The nominal speed limit for traffic is 30 miles per hour.

General Ventilation System—Early in the planning of the tunnel the decision was reached to provide ventilation by blowers at the entrances of the two tubes, forcing the full required volume of fresh air for the entire length of that tube through injector nozzles formed around the periphery of the tunnel a short distance in from the entrance, on a modified Saccardo system. When the detail design was entered upon, however, it was found that the draft velocity needed to assure the proper induced draft under unfavorable conditions exceeded 45 miles per hour at the nozzles if the required air volume for normal traffic was to be supplied. Excess capacity to meet emergency conditions would require considerably greater nozzle velocity. These velocities seemed undesirably high, and therefore the plans were changed, after the tunneling work was well under way, to provide for a single ventilating plant at mid-length, operating partly by exhaust and partly by blower action. Under this system, which was carried out, half of each tube, from entrance to mid-length, is ventilated by the inflowing fresh air from the entrance end, exhausted through an upcast at this point, while the farther half of the tube is ventilated by fresh air blown in through nozzles just beyond the exhaust upcast. Thus the air in the tunnel is always moving in the same direction as the traffic.

At mid-length of the tunnel, ground level is about 220 ft. above the roadway. The fan houses are at the surface, connecting with the tunnel by two shafts 13x36 ft., each placed central over one tube, the long dimension of the shaft transverse to the tube. Partitions in the shafts, 10 in. thick, divide them into four parts, the middle two being the exhaust and the outer two the supply ducts. The exhaust ducts, each of 10 ft. 10 in. by 13 ft., with aggregate sectional area of 282 sq.ft., occupy the full width of the tube and open directly into it, with no entrance modification except rounding of the front and rear edges. The supply ducts, each 5 ft. 11½ in. by 13 ft., or 78 sq.ft. in area, are turned forward (in the direction of traffic) alongside the tunnel and terminate in vertical slots in the tunnel sidewalls. The duct sides are so shaped as to form nozzles of 34 sq.ft. area each, directed toward the axis of the tunnel at an angle of 2½ in 12 (Fig. 2).

Required Ventilation—It was learned during the seven months of unventilated operation of the tunnels that the current of air induced by the automobiles moving through the tunnel is sufficient to provide the required dilution of the carbon monoxide produced by them (see the report above referred to). At the time the blower plant was designed this fact was not known, and the design was based on passing the full required volume of fresh air through the blowers. Provision was made for operation of the fans at part capacity, however, and also at excess capacity (double normal power plus 25 per cent overload), so that in practice it

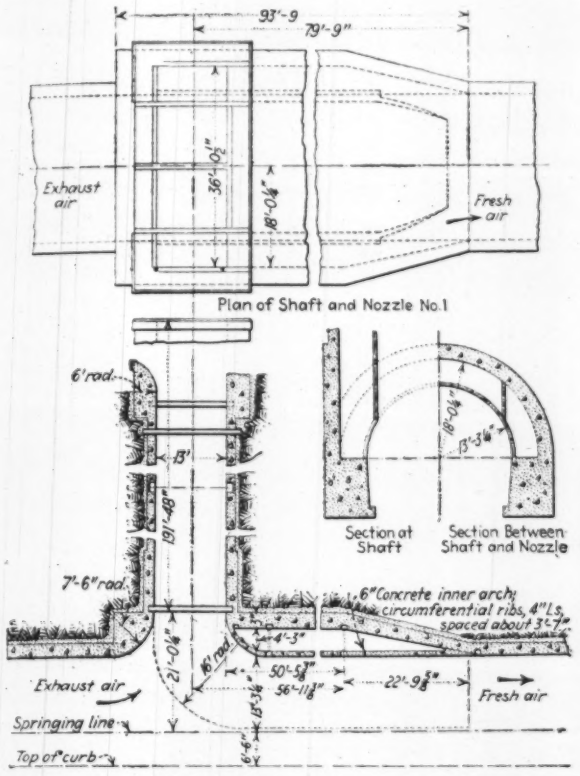


FIG. 2—EXHAUST AND FRESH AIR SUPPLY SHAFT AND NOZZLES

One shaft over each tunnel. Two central compartments of shaft lead the exhaust air from the entrance half of the tunnel to the exhaust fans and stacks. Two side compartments lead fresh air from the supply blowers to nozzles in the side walls of the tunnel, facing in the direction of the traffic.

is possible to adapt the operation to light load as well as to emergency conditions.

From vehicle tests made by the U. S. Bureau of Mines several years ago for the New York and New Jersey Interstate Tunnel Commission it was concluded that in mixed truck and passenger car traffic the average carbon monoxide production might be taken as 1½ cu.ft. per minute per vehicle. From Prof. Yandell Henderson's physiological tests at New Haven, made for the same commission, it was concluded that an average pollution of 3 parts and maximum of 6 parts in 10,000 should not be exceeded in the tunnel atmosphere. These figures when taken together indicate that each vehicle in the tunnel requires a fresh air supply of 2,500 cu.ft. per minute. The number of cars in the tunnel under full normal traffic conditions was taken as 117 for each tube (double line of vehicles, cars spaced 100 ft. in each line). The total supply volume for traffic on this basis was found to be 280,000 cu.ft. of fresh air per minute for each tube. This duty was divided equally between exhaust and supply, so that the capacity of each of the two sets of fans for each tube was fixed at 140,000 cu.ft. per minute. With two fans per set, this is 70,000 cu.ft. per min. for each fan; this capacity can be increased by increasing the speed of the motor and fan to a point where each fan will deliver 140,000 cu.ft. per min.

It was considered desirable to provide a large overload capacity, as more cars than the number assumed might be in the tunnel during blockades and similar abnormal conditions. This excess capacity was furnished by equipping each fan with two motors, clutch-connected, controlled so as to permit operating the fans at an overload speed of 25 per cent above the maximum just given.

Fan Plant—Each fan unit consists of a multi-blade wheel 115 in. in diameter by 54 in. long. The fan shaft carries two clutch-connected belt pulleys, for drive by either or both of two motors. A single motor can operate the fan at rated capacity. The rated capacity

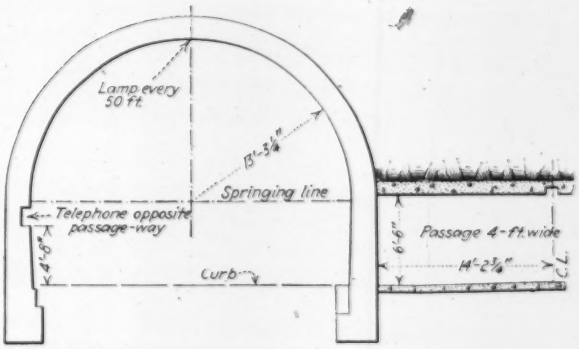


FIG. 4—CROSS PASSAGE BETWEEN TUNNELS

Doors at each end of each of these passages prevent mutual interference of the ventilation currents in the two tubes.

of the supply fans is 140,000 cu.ft. per min. against a static pressure of 1.7 in. water, at a speed of 140 r.p.m. The exhaust fans are rated at 140,000 cu. ft. per min. against 0.62 in. water at 90 r.p.m. Under these operating conditions the velocity head of the air at the nozzles in the tunnel is 1.06 in. water; the drop of 0.64 in. is due to friction losses.

Two exhaust fans and two pressure fans serve each tube. Each exhaust fan discharges into the base of a 10x10-ft. brick stack 110 ft. high, the plant having four stacks in all. These were provided because of a public school adjoining the plant; it was desired to avoid any occasion for anxiety on the part of parents concerning the effect of the polluted exhaust upon the health of the school children. The stacks discharge at a level above the schoolhouse roof.

The power required to operate a pressure fan under the above conditions is 80 hp. and that for an exhaust fan 40 hp. With both motors in service, each fan has an overload capacity of 125 per cent, corresponding to 25 per cent excess discharge.

Electric power is brought into the plant from two supplies at 11,000-volts, a.c., and is stepped down and

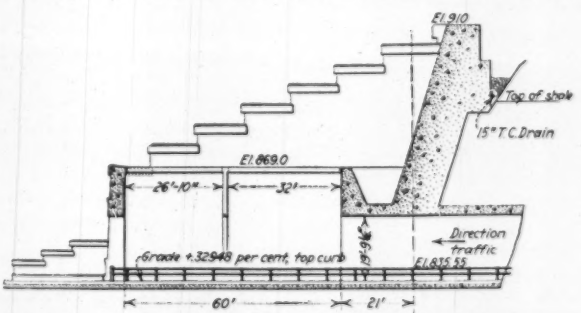


FIG. 3—WIND TRAP AT EXIT END OF TUNNELS

converted to 225-volt direct current in a converter room adjoining the fan rooms. All the fan motors and their magnetic coupling-up clutches are controlled from a control board in the converter room. In the same room there is installed a carbon monoxide recorder designed by the Bureau of Mines, which traces a continuous record of C O percentage.

Tests of air movement in the tunnels by the U. S. Bureau of Mines, with the fans driven by two motors each, operating at overload speed and capacity, indicated a volume of 1,100,000 cu.ft. of air per min. passing through each tunnel. It may be assumed, therefore, that the emergency capacity of the fans under blockade conditions in the tunnels will be nearly three times the normal air volume.

Inspection of the tunnel at a time of very light traffic, with fans operating at half speed, showed that the air movement in the short section at mid-length of the tube between exhaust uptake and supply nozzles is toward the exit end, or from uptake toward nozzles. This indicates that the induced-draft effect of the blower blast is stronger than the exhaust suction. No short-circuiting of air appears to occur.

The plant was designed under the direction of A. D. Neeld, engineer of design and construction of the tunnel for Allegheny County. The fans were built by the Bailey Manufacturing Co. of Milwaukee, and the electrical equipment by the Westinghouse Electric & Manufacturing Co., of East Pittsburgh. Booth & Flinn, Pittsburgh, were general contractors for the plant. The plant cost about $600,000, including real estate and

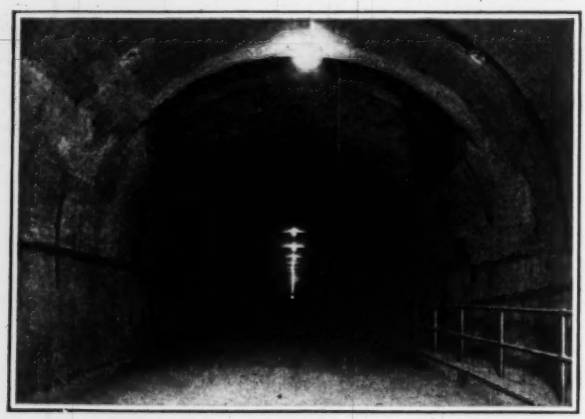


FIG. 5—UPTAKE AND NOZZLES SEEN FROM TUNNEL

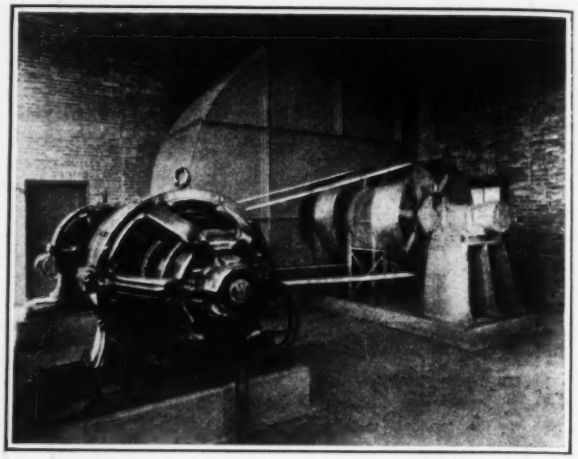


FIG. 6—ONE OF EIGHT TWO-MOTOR FANS IN FAN HOUSE

buildings. Its annual operating cost at average half normal speed will probably range from $15,000 to $20,000.

Wind Break—At the exit end of each tunnel, special construction has been resorted to as a means of providing a wind break to prevent obstruction of the outgoing ventilation current by head winds. This construction is shown in Fig. 3. It consists of a wind trap formed by extending the tunnel some 75 ft. beyond the face of the hillside and forming two large openings in the roof of this extension with side walls carried up high enough to form in effect low upcasts or stacks. The outgoing ventilation current can here pass upward to the open air, and at the same time an opposing current of wind from the outside entering the tunnel portal can also pass up when it is deflected by meeting the ventilation current. These traps are said to be entirely effective.

Traffic Control and Policing—Up to the present no necessity has arisen for providing any arrangements for traffic control other than keeping a motorcycle policeman in the tunnel during the greater part of the day (two 8-hr. shifts). No attempt has been made to limit the spacing of cars or to control their method of operation, except through such control of speed and reckless driving as the traffic policemen may exercise.

The ventilating plant is operated from the converter room of the plant, as already mentioned. The operating force comprises a superintendent, three shifts of two operators each, an assistant operator to each operator, and a force of five men who serve as helpers, cleaners, and tunnel maintenance men. Usually three of these men are down in the tunnel, and it is part of their duty to report any traffic conditions that require a change in the amount of ventilation supplied. Maintenance men or traffic policemen can communicate with the operating room by telephone from any one of the cross passages; such passages, constructed as in Fig. 4, are spaced about 500 ft. along the tunnel. However, the operators largely depend on the indications of the carbon monoxide recorder, and increase the fan output whenever the curve traced by the recorder approaches the limit of 4 parts in 10,000.

Present practice in operating the plant is to keep one supply fan and one exhaust fan in operation throughout the 24 hours. Two supply and two exhaust

fans are operated throughout the day at reduced speeds. Traffic conditions control the operation, special attention being given to the traffic peaks. Overload operation by switching in the second motor of each fan is resorted to only at times of congestion or similar emergency.

The tunnel is being operated by the Board of County Commissioners of Allegheny County.

Better Prospects for Settlement of Owens Valley Dispute

Clearing House Association Acts as Mediator in Fight Between Ranchers and Los Angeles Over City Water Rights

DURING the past two years there has been serious friction between water users in Owens Valley and the city of Los Angeles over the city's policy in diversions from Owens River and in acquiring more land in the valley. Since the first of the year, however, the situation has changed materially and there is now believed to be good prospect for a final settlement of differences. It is expected that the city will buy valley holdings at a mutually satisfactory price in all cases where the farmers are willing to sell. A brief résumé of the situation is presented in the following:

The differences date back to a time, before the actual construction of the aqueduct, when investigation of the proposed Owens Valley project was begun by the U. S. Reclamation Service. This was in July, 1903. At that time 35,000 acres of land were under irrigation and in productivity and it was proposed to impound sufficient of the flood waters flowing into the valley to bring a total of 146,000 acres under cultivation.

Early Irrigation Prospects—The project was heartily welcomed by residents of the valley. Co-operation was given by those who were already deriving the water supplies essential to their farms from sources which would be involved in the project and all were interested in the completion of the project, which promised prosperity for the valley.

Investigation covering stream measurements, soil tests, water duty and surveys of valley lands as well as reservoir sites were completed and the first reports on the project, at least, were favorable. Late in 1905, the data collected were sold by the U. S. Reclamation Service to the city of Los Angeles, and extensive land holdings, it was then learned by the local residents, had already been acquired in the interest of Los Angeles. With this announcement came that of plans for the Los Angeles aqueduct. The boundary of the National Forest was extended over areas in Owens Valley, including sites of proposed storage reservoirs as well as much of the agricultural land which might otherwise have been brought under irrigation. These boundaries so remained until changed by Presidential proclamation in 1911.

These events greatly disappointed the residents of Owens Valley, and the disappointment was not lessened when the city purchased large areas of farm lands in the vicinity of Independence, the county seat, and allowed them to revert to desert while being sold for draft of underground water supply.

Early Relationship—During the first few years of aqueduct operation, controversies over water rights were not acute, although Los Angeles protested extensions of agricultural areas and consequent use of water and on two occasions its representatives (so valley residents say they can prove) forcibly destroyed storage dams built under federal authority for storage for irrigation purposes.

The past four years have been years of very deficient stream flow. The full amount of water desired for the aqueduct has not been available, and, since the aqueduct intake is in the lowest part of the valley, water used for irrigation in the upper part of the valley lessened the flow into the aqueduct. The agricultural rights under which the water is used in the valley date back, in some cases, prior to 1870, and all of them antedate aqueduct rights. The emergency in recent years has been aggravated, water users point out, by the fact that Long Valley Reservoir, originally included in the plans by Los Angeles as part of the completed aqueduct, has not been constructed.

To increase the aqueduct flow in this low water period Los Angeles sought relief by purchasing of some of the valley farms with their appurtenant water rights. Gross injustice has been charged by valley residents in connection with these purchases on the ground that most of the water rights consist of shares in various mutual ditch companies and that the city, after acquiring a majority interest in such ditch companies, sought to operate the ditch without proper regard for the minority owners.

Violence Again a Factor—There is some difference of opinion as to whether the mysterious dynamiting of the aqueduct last year near the intake (*Engineering News-Record*, June 5, 1924, p. 991) was a piece of individual mischief or whether it was done with the knowledge of water users. There is no doubt, however, about the wholesale participation of valley residents last fall when the waste gates were seized and the aqueduct flow diverted, thereby cutting off the city's supply (*Engineering News-Record*, Nov. 20, 1924, p. 845).

Negotiations between the ranchers and the city were attempted from time to time during these incidents but they were never very successful. However, one of the leading ranchers was a banker and he appealed to the Los Angeles Clearing House Association to act as arbiter or judge, in the controversy. The association undertook this task as a disinterested party, but one not vested by either side with authority.

On the occasion of the seizure of the waste gates, the men who held them dispersed only after the negotiations between the Owens Valley Irrigation District and the Los Angeles Clearing House Association seemed to give promise that a peaceable solution of differences could be reached. However, on final analysis it developed that the irrigationists, or rather those who supported the district (for there was some difference of opinion in the valley), were demanding more than the city would pay. In addition to the price asked for lands involved, the irrigationists wanted $5,300,000 "to be used for reparations and to compensate the ranchers for shrinkage in values, and reimburse the property owners for a like shrinkage in the five towns of Bishop, Laws, Big Pine, Independence and Lone Pine." Los Angeles believed that no "reparations" were due or could be legally paid and took the position that the city's activities had in reality enhanced values and increased business in the valley, and that the district was attempting to unjustly saddle the city with all losses and failures of recent years due to whatever cause.

This correspondence culminated in a letter from the president of the Owens Valley Irrigation District to the Clearing House Association last December which was in the nature of an ultimatum. The reply from J. A. Graves, president of the Clearing House Association, is credited with helping materially to bring the farmers to a point of view favorable to negotiation on what the city considers to be a reasonable basis and said in part, "With a friendly spirit toward the Owens Valley people I desire to inform you that your veiled threats of further violence and damage to the aqueduct will injure your cause with any fair-minded people. The blustering, swaggering bully of the old days has passed away and it ill becomes you in sending this communication to the members of the Los Angeles Clearing House Association to resort to such tactics."

The Present Situation—In the early days Owens Valley had prospects for a convenient market in the Nevada mines, which have since been worked out; farm lands in other parts of the state have been developing rapidly, and the uncertain future of the valley has not been conducive to business enterprises. The valley must ship its produce 223 miles to reach large markets. Being at an elevation of about 4,000 ft. the valley has a short growing season, and a considerable part of its area is not high-grade farm land. An estimate of the area in the valley now under irrigation, made recently by Los Angeles engineers, places it at 30,000 acres of cultivated land and 20,000 acres of pasture land. From the Los Angeles point of view this is the maximum that should be under irrigation.

In recent years Los Angeles has bought some 25,000 acres in the valley, both irrigated and unirrigated, at prices which are claimed to be in excess of the value justified by purely agricultural uses. In order to get title to all the remaining water needed to supplement the aqueduct flow the city would need to acquire approximately 25,000 acres more. For this additional area the city has stated its readiness to pay the same rates as heretofore. Within the last few months a considerable number of the farmers have been coming to see in this an opportunity to sell out to advantage.

Sewage-Works for Winston-Salem, N. C.

Plans for a 9-m.g.d. sewage treatment plant using the direct-oxidation process, with provision for increasing the capacity to 15 m.g.d., have been made for the city of Winston-Salem, N. C. Contracts have been let and construction is in progress on the 9-m.g.d. plant. The approximate cost of this plant is put at $400,000, and the estimated cost of the 15-m.g.d. plant at $600,000. Before the sewage is subjected to the direct-oxidation process, it will be passed through fine screens of the Dorr type. No grit chamber is provided, but the fine screens are protected by racks placed in the outfall flume. Dorr thickeners will be used in the final settling tanks. The thickened sludge from the clarifier will be pumped to a slurry tank located near the filters; from this tank the filter is fed by a pump, the overflow draining back to the tank by gravity. The sludge will be dewatered to 65 per cent moisture or less and then scraped off the conveyor belt and disposed of in cars, either to be used in fills or sold as fertilizer. Harry L. Shaner, commissioner of public works of Winston-Salem, and formerly city engineer of Lynchburg, Va., designed the plant.

Variations in Physical Values of Public Utilities

Classified Valuation of Various Items in Groups of Water-Works and Other Plants for Period 1913-24

By C. F. Lambert
Burns & McDonnell Engineering Co., Kansas City, Mo.

In the valuation of utilities, and especially in rate hearings before courts or commissions, the question which lends itself to the most extended argument is: "What Basis of Pricing Should Be Used?" Even after the basis has been established, the contending parties, as well as the courts and commissions, have been interested in knowing what would be the relative value between present and pre-war prices, five- and ten-year averages, etc. To work out the value of a particular utility on several different bases by applying the various

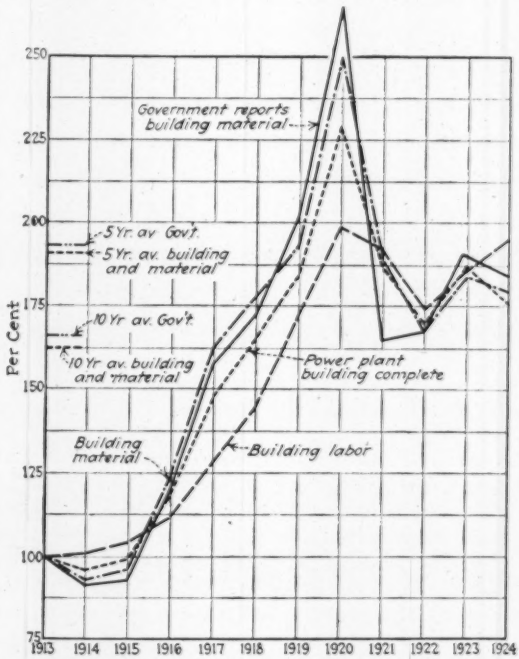


FIG. 1—RELATIVE VALUE OF LABOR AND MATERIAL IN POWER HOUSE OR PUMPING STATION, 1913 TO 1924
Showing also value of building complete and government reports of value of building material.

prices to each item entails much labor and, as a rule, where the valuation has been worked out accurately on one basis, it is not necessary to have the other values more than relative. But it is important to all concerned to know that the figures are reasonably accurate. Usually, if the valuation is not worked out accurately on each basis, the one valuation which has been worked out is applied to percentages based on government statistics, or known prices on various types of equipment, machinery or labor. This does not take into account the actual items which go to make up a utility, nor the ratio which each item represents in that type of utility.

To get at this matter in a way which would be reasonably accurate, and which would make it easy to determine these relative values, the writer has worked up valuation data for 25 water-works, 25 electric light

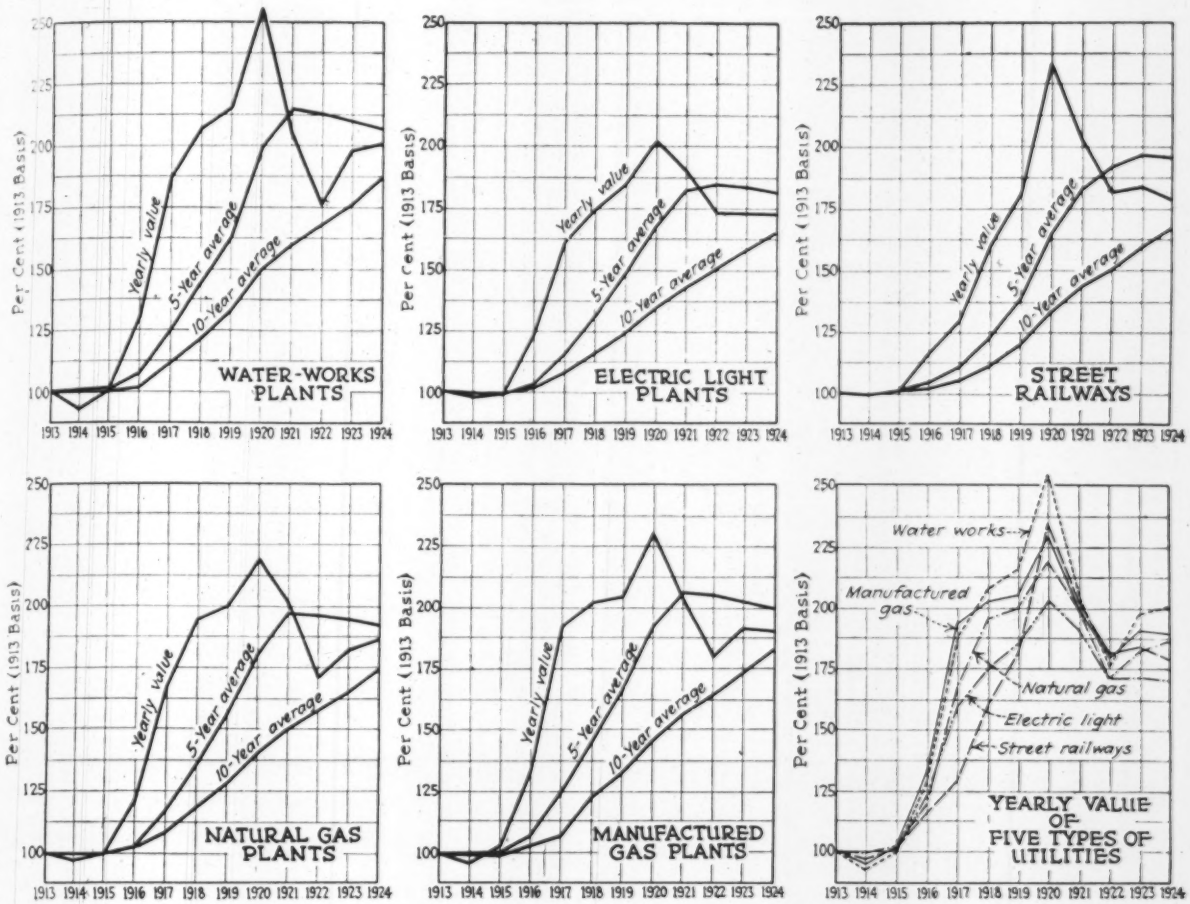


FIG. 2—YEARLY AND FIVE- AND TEN-YEAR-AVERAGE VALUES OF FIVE TYPES OF UTILITIES, 1913 TO 1924
See accompanying table for yearly figures under five grand divisions and by totals; and notes to table for additional details.

RELATIVE YEARLY VALUES OF FIVE MAIN ITEMS ENTERING INTO PHYSICAL VALUE OF FIVE UTILITIES, 1913-24

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
Water-Works Plants												
Land	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Building	11.2	10.8	11.1	13.3	16.5	18.5	20.6	25.6	20.9	19.0	20.8	20.7
Equipment	12.1	12.0	14.0	17.3	22.6	23.4	24.3	26.2	23.4	21.8	22.9	23.0
Distribution	72.7	67.1	71.3	94.1	143.2	161.1	165.8	197.8	155.8	130.1	149.8	152.2
Miscellaneous	1.1	1.1	1.2	1.4	1.8	2.0	2.3	2.8	2.2	2.0	2.0	2.0
Total	100.0	93.9	100.4	129.0	187.0	207.9	215.9	255.3	205.2	175.8	198.4	200.8
Electric Light Plants												
Land	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Buildings	10.1	9.7	10.0	12.0	14.9	16.7	18.5	23.1	18.9	17.1	18.8	18.6
Equipment	38.9	36.7	36.7	47.9	73.5	79.5	81.0	86.7	84.6	75.1	73.4	73.5
Distribution	44.8	43.5	47.1	56.1	63.4	69.6	75.2	82.6	77.4	70.4	70.4	69.6
Miscellaneous	3.4	3.4	3.4	4.1	5.1	6.0	6.8	8.6	6.8	6.2	6.2	6.1
Total	100.0	96.1	100.0	122.9	159.7	174.6	184.3	203.8	190.5	171.6	171.6	170.6
Street Railway Systems												
Land	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Buildings	4.7	4.5	4.6	5.6	6.9	7.8	8.6	10.8	8.8	8.0	8.8	8.7
Track Const.	64.3	63.1	63.4	71.9	83.3	104.8	113.8	144.1	119.9	105.4	113.6	112.8
Span Const.	5.8	5.4	6.3	8.7	9.9	9.7	10.0	11.1	9.0	8.5	8.7	8.8
Cars and equipment	20.9	22.4	22.8	25.1	27.2	31.1	44.4	61.1	59.1	53.0	47.0	42.9
Miscellaneous	1.7	1.6	1.6	2.2	2.9	3.2	3.5	4.3	3.6	3.2	3.3	3.2
Total	100.0	99.6	101.3	116.1	132.8	159.2	182.9	234.0	203.0	180.7	184.0	179.0
Natural Gas Plants												
Land	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Buildings	1.6	1.5	1.6	1.9	2.4	2.6	2.9	3.7	3.0	2.7	2.9	2.9
Equipment	1.7	1.6	1.8	2.6	4.0	3.6	3.5	4.1	3.1	3.1	3.1	3.1
Distribution	92.2	89.9	92.0	111.0	155.7	182.9	186.5	202.4	187.3	158.4	168.7	173.4
Miscellaneous	2.9	2.8	2.9	3.3	4.4	5.1	5.8	7.8	6.4	5.6	5.8	5.7
Total	100.0	97.4	99.9	120.4	168.1	195.8	200.3	219.6	201.4	171.4	182.1	186.7
Artificial Gas Plants												
Land	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Buildings	6.8	6.5	6.7	8.1	10.0	11.2	12.5	15.5	12.7	11.5	12.6	12.5
Equipment	30.4	29.1	33.1	49.9	76.4	68.7	67.2	75.9	66.1	62.8	63.4	61.3
Distribution	56.5	54.4	55.6	68.1	98.3	114.8	116.5	130.4	115.6	98.2	107.5	108.6
Miscellaneous	2.1	2.1	2.1	2.5	3.1	3.6	4.1	5.5	4.6	4.1	4.1	4.0
Total	100.0	96.3	101.7	132.8	192.0	202.5	204.5	231.5	203.2	180.8	191.8	190.6

Water Works: 25 systems; 68 items, of which the main ones are land, buildings, boiler room equipment, pumps, steam piping, miscellaneous equipment, cast-iron pipe, wrought-steel pipe, wood pipe, valves and hydrants, meters, standpipes, reservoirs, furniture and fixtures, tools, autos and miscellaneous.

Electric Light Plants: 25 plants; 84 items of which the main ones are land, buildings, boiler room, engine room and miscellaneous equipment, power transformers, lighting equipment, poles, conductors, distribution transformers, meters, underground conduits, furniture and fixtures, tools, autos and miscellaneous.

Street Railways: 10 systems; 82 items of which the main ones are land, buildings (car barns and shops) tangent track, special layouts, grading, paving, bridges, span construction, poles, conductors, cars and equipment, furniture and fixtures, tools, autos and miscellaneous. Power plant buildings and equipment excluded because power is so frequently bought from a separate department or company.

Natural Gas: 11 systems; 58 items, of which the main ones are land, buildings, holders, miscellaneous equipment, cast-iron pipe, wrought-steel pipe, regulators, governors and valves, meters, furniture and fixtures, tools, autos and miscellaneous.

Manufactured Gas: 20 plants; 63 items, including land, buildings, boilers, gas machinery, holders, miscellaneous equipment, cast-iron pipe, wrought-steel pipe, regulators, governors and valves, meters, furniture and fixtures, tools, autos and miscellaneous.

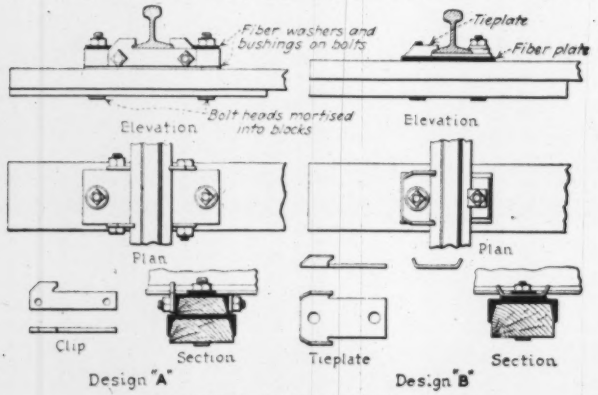
plants, 10 street railway systems, 11 natural gas and 20 manufactured gas systems. Omitting any going value or intangibles, there were determined for each year from 1913 to 1924 the relative proportion of the main items which go to make up the plant and these were subdivided into various items of labor and material. It is interesting to compare these figures with government statistics on building materials. Fig. 1 shows the relative yearly value of the labor and material in the proportion in which it enters a power house or pumping station, the complete value of the building and the government building statistics.

The accompanying table shows by years from 1913 to 1924 the relative percentages of land, buildings, equipment and miscellaneous going into the cost of each of the five classes of utilities, taking year-to-year price valuations into account. Notes with each section show in more detail the sub-items included. The six sets of curves comprising Fig. 2 show (1) the relative yearly variations in the total physical costs, together with figures for each year of the average value for the five and the ten years preceding—all years before 1913 having been taken as 100 per cent of the 1913 values; (2) relative total values for each of the five classes of utilities, by years.

Experimental Steel Ties Designed by A.R.E.A. Committee

THAT it is desirable to experiment more extensively with substitute ties in preparation for possible future requirements has been urged at different times by the Tie committee of the American Railway Engineering Association, which committee has also for some time made an annual service report on various experimental steel and concrete ties. To supplement its arguments the committee in its 1925 report, presented at the recent annual meeting, submitted a tentative design for a steel tie, as shown by the accompanying drawing.

This tie is composed of an inverted commercial steel channel with a filler block of wood or concrete under each rail. No dimensions are given, the details of design being left to the railroad making the experiment. The tie is evidently shallow and the committee admits that in this and other respects it is probable that a special form of section would be superior, but such sections are not available. Although the committee suggests that the steel ties be placed between wood ties, it is generally considered that such an arrangement is unsatisfactory for test purposes, since there is no way of knowing to what extent the experimental tie is relieved by the adjacent wood ties. A better plan is to lay a stretch of track with test ties only.



A.R.E.A. EXPERIMENTAL STEEL TIES

In the *A* design, each rail rests on a short piece of steel channel with an insulating cushion block of wood placed between this and the top of the tie, the parts being secured by through bolts. It seems likely that with such a combination it would be difficult to maintain exact gage of track, due to slipping of the parts. In the *B* design, only a fiber insulating plate is placed between the tie and the rail.

Rail fastenings used in the *A* design represent a novel type never yet applied in practice. On each side of the wood block is a flat plate with a hook-shaped lug to engage the rail base, the two plates holding the inner and outer sides of the rail and being held in place by two horizontal bolts through the wood block and rail support. In the *B* design, the fastening consists of a tieplate with hooked ribs to engage the outside of the rail base, while the inner edge is held by a clip on one of the bolts securing the base block to the tie. Fastenings of this general type have been used in Europe. An abstract of the committee's statement is given below:

The substitute tie is purposely designed to be made from standard sections. Special sections would probably be better, but the committee fears that if special sections were recommended, few, if any, ties of this general form would be tested. The ties shown can be readily made in almost any railroad shop. They are suitable for insertion in track between wooden ties and should not take an undue proportion of the load from the adjacent ties. One difficulty with certain steel ties when placed between wooden ties has been that because of their greater stiffness the steel ties took more than their share of the load and failed on that account. It is, however, not unlikely that tests will indicate that special channels with deeper flanges would be better for this purpose.

Insulation of the bolts from the tieplates and main channels is obtained with fiber bushings and washers. The accommodation to rails of different base widths is to be made by changing the clips or the tieplates. These ties have no provision for shimming. The blocks under the main channels can be made of treated timber, concrete or other material. If of treated timber, because of their relatively small size and their protection from excessive stress or crushing, these blocks can be made of cheap material such as second-hand car timbers. It would be very desirable to use copper-content steel for these or other ties to be tested.

As defects are developed by tests under traffic, efforts should be made to overcome these and thus progress toward satisfactory ties. While no substitute tie can compete with treated wooden ties on an annual cost basis at the present relative prices for timber and substitute materials, it is nevertheless desirable to develop the best substitute tie before possible changes in the price relation might make the substitute tie desirable for extensive adoption.

Historical Water Power Exhibition

A historical model exhibition in the field of water power and pumping, covering the period from the 15th to the 18th century, will be displayed by the city of Augsburg, Germany, at the coming annual meeting of the Verein deutscher Ingenieure. Records indicate that mills driven by water power existed in Augsburg as early as the 11th century, and six were in operation in the year 1276, this number increasing tenfold in the following five years and extending the industrial use of power to a large number of industries from diamond grinding to cloth fulling. In connection with this exhibit the city will also show models and drawings of municipal engineering structures in the field of water supply, power, sewerage, and gas.

Water-Works Problems and Standardization

Papers and Reports Before the American Water Works Association Centered Largely in Perfecting the Association's Manual of Water-Works Practice

Both the papers and committee reports presented before the 45th annual convention of the A.W.W.A. at Louisville, Ky., were designed to aid in the final shaping of the Manual of American Water-Works Practice soon to be published under the editorship of the Standardization Council of the association. Abstracts of the papers and reports and the discussions they drew out follow. The business and entertainment features of the convention are given in our news section.—EDITOR.

Financial Status of Water-Works in the United States

BY LEONARD METCALF
Of Metcalf & Eddy, Consulting Engineers, Boston, Mass.

WITHOUT the public service commissions it would not have been possible to bridge the gap between pre-war and post-war conditions short of the failure of many [privately-owned] water-works properties, the impairment of borrowing capacity of others and a very general lowering of the standard of service rendered to the public by them. Records seem to show that there was a delay of 1½ to 2 years by the commissions in giving relief, and that the total cost to the water-works of this country was probably well in excess of $250,000,000—in effect the contribution of this industry to the fighting of the Great War.

PERCENTAGE INCREASES IN COMMODITY PRICES OVER PRE-WAR BASIS

Year	U. S. Dept. of Labor (1919 Revision) Per Cent	Dun's Per Cent	Bradstreet's Per Cent	*Engineering News-Record* Per Cent
1916	27	21	30	47
1917	77	67	72	81
1918	94	87	106	89
1919	106	88	105	99
1920	126	102	107	151
1921	47	39	25	102
1922	49	41	33	74
1923	54	55	47	114
Average for 8 yrs.	73	63	66	95

Pre-war basis, here used for:
U. S. Dept. of Labor, Year 1913
Dun, Average of years 1912-13-14
Bradstreet, Average of years 1912-13-14
Engineering News-Record, Year 1913

The accompanying table gives for the 8-year period 1916-1923 the percentage increase in commodity prices over the pre-war basis, as shown by various agencies. The average of Dun's, Bradstreet's and the United States Department of Labor indexes is about 52 per cent for the year 1923 and 67 per cent for the period. The average of the *Engineering News-Record* index numbers, most significant in water-works practice, is 114 per cent for 1923 and 95 per cent for the 8-year period.

Recent valuations of water-works indicate that fair reproduction costs are somewhat over double pre-war reproductions costs.

At present the average rate of return is probably about 20 per cent in excess of the pre-war basis, compared with an increase of about 50 per cent in commodity prices and 100 per cent in the water-works field; and values are undoubtedly approximating these higher planes of cost.

* * *

Water Supply for Fire Protection

BY V. BERNARD SIEMS
Water Engineer, Baltimore, Md.

IMPOUNDING works are a factor in fire protection in the smaller communities only, where there is little or no distributing reservoir capacity and probably no means of balancing the distribution system, unless perhaps by a standpipe. Feeder supply mains should be in duplicate. High pressures in distribution systems are not desirable, especially since the advent of the automobile fire pumper. Instead of high pressure, it is better to provide water main capacity, in which case 50 to 60 lb. average pressure on a well gridironed system may suffice, with 75 lb. in congested sections with high buildings. Emergency service should be provided, with valve-operating trucks, and with district service in large cities. Private fire protection service lines should carry a fixed service charge. These lines should be smaller than the street main that feeds them. It is undesirable to have any mechanical connection between private and public supplies. It is doubtful whether a separate high-pressure system is economically desirable, late experience indicating that the same fire protection can probably be furnished from a properly designed distribution system.

Zoning provides for the engineer not only a clearly defined picture of the nature of the demand which will be made upon the water supply, but defines this picture by giving such details as the height and bulk of buildings, the area of clear spaces and highways which become factors in estimating the probable future fire flow requirement, for the required fire flow is the maximum demand that will be placed upon the water supply. As has been pointed out by H. Malcolm Pirnie in a recent paper before the American Society of Civil Engineers, "Stability in existing water-works structures and in present provisions for the future water supply of a community is dependent on stability in building, and may be secured by the early adoption of a carefully prepared zoning plan and ordinance. In preparing a zoning plan, the water supply must be given due weight with all other purposes in view. Water has been and still is about the cheapest of all public necessities. Its cost in the future, however, will be greatly increased in some communities if the city plans are made without consulting the water authorities. It is possible even to destroy an existing source of water supply by disregarding this phase of the problem, thus burdening the city with a cost for new works out of proportion to the benefits resulting from zoning.

Discussion—J. J. O'Brien, fire chief, Indianapolis, and Clarence Goldsmith, assistant chief engineer, Board of Fire Underwriters, Chicago, opened the discussion. Mr. O'Brien referred to the co-operative fire prevention work in his city, led by Frank C. Jordan, president, American Water-Works Association. and secretary of the Indianapolis Water Co., and joined in by the citizens and various organizations. Mr. Goldsmith favored an allocation of the first cost of the domestic and fire protection services, the latter to be met by taxation, and was against a charge for fire sprinkler water. In general, the installation of meters on private fire lines is undesirable, but a yearly charge to cover inspection to see that water is not being improperly used is proper.

Dow R. Gwinn, Terre Haute, Ind., urged that fire protection should be paid for and depreciated cross-connections. A value on each fire hydrant branch was favored by several speakers, some of whom said it is provided when new hydrants are set or old ones repaired. B. C. Little, superintendent of water-works, Rochester, N. Y., said that while a valve to every hydrant is important in a business section it is not necessary in resident districts, where control may be had from the gate at each end of the block.

Cross-connections were again brought up, this time by C. M. Baker, engineer, Wisconsin Board of Health, Madison. After stating that the Conference of State Sanitary Engineers (engineers in the state and federal health services) had gone on record against cross-connections, Mr. Baker introduced a resolution of like intent which, after much discussion and some changes, was adopted as the sense of an apparently large majority of those then in the convention

hall, with the understanding that it would go to the executive committee of the association for consideration. The resolution was a declaration against any direct connection between a potable water supply and any other supply except when the second supply was also potable and subject to sanitary control.

A show of hands was called for to get an idea of the practice as to a number of matters related to fire protection. As to charges for private fire protection service, there were 30 yeas to 3 nos. On metering these services, the showing was 10 yeas to 18 nos. Emergency crews to handle water-main breaks were reported by representatives from New Bedford, Mass., New York City, Syracuse, N. Y., Corry and Scranton, Pa., Baltimore, Md., the Washington Suburban Sanitary District, Lexington, Ky., Indianapolis, Ind., St. Paul, Minn., and St. Thomas, Ontario.

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Experience with Large Water Tunnels in Chicago

BY ARTHUR E. GORMAN
Chief Sanitary Engineer, Chicago Department of Health

INVESTIGATIONS made since the Chicago typhoid outbreak late in 1928 have shown leakage into the 68th St. lake tunnel and also contamination of the water delivered through the many miles of land tunnels, some of this being due to the heavy draft and resultant negative head on the land tunnels and some to private connections with the tunnels or shafts. The studies show:

(1) The value of bacterial analyses of samples taken at control points, from source to consumer's tap. (2) Samples should be collected shortly after periods of excessive rainfall. (3) Daily samples over extended periods give more reliable data on tunnel leakage than a number of samples on one day, especially when the latter are negative. (4) Meteorological data are important in Chicago where sole reliance is placed on chlorination. (5) Water tunnels under private property and private connections therewith are potentially dangerous. (6) Any program [for the future of Chicago] which calls for land tunnels to deliver filtered water should provide for the complete protection of these tunnels against all possible contamination, and also for disinfecting the water immediately before it is pumped from the tunnels to the distribution system.

Discussion—W. W. Brush, New York City, said that the paper just read affords one of the strongest arguments against cross-connections he had ever heard. As to possible leaks into masonry aqueducts, Mr. Brush said New York City is changing its chlorine application points to give protection against seepage. W. W. Gore, Toronto, asked whether the experience at Chicago was against the use of low-pressure tunnels unless the water is filtered. Mr. Gorham said studies of that question are being made.

* * *

Service Reservoirs and Pressure for Domestic Service

BY A. C. HUTSON
Assistant Chief Engineer, Committee on Fire Protection and Engineering Standards, National Board of Fire Underwriters, New York City

SERVICE reservoirs and distribution pressures raise questions which may require that a proper balance be struck. The trend is now toward higher domestic pressures with reliance upon automobile pumpers for fire pressure.

All things considered, a static pressure of from 60 to 75 lb. is a desirable normal in American cities since it will: (a) supply domestic consumption to all except the highest buildings (over 10 stories); (b) permit considerable fluctuation or lowering of pressure locally during peak demand without leaving extensive sections poorly supplied with water; (c) insure quicker operation of the fire department, by allowing direct hook-up of hose lines with hydrants; (d) assure effective sprinkler supply to a building of 4 or 5 stories; (e) enable smaller service pipes to be utilizel; (f) afford more satisfactory flow for manufacturing processes requiring large quantities of water, for use in lawn sprinkling and for other needs.

Many existing water systems are functioning at materially lower pressures than the desirable one of from 60 to 75 lb. Where supplied by direct pumpage, an increase is readily feasible; in some instances this would mean the cutting out of a standpipe or tank, but in a majority of cases these devices are of small capacity and are located near the pumping station; their main function has been to cushion the pump discharge. The need for them is slight, and they have been abandoned by many cities.

For the village or small town, service reservoirs, standpipes or tanks may permit intermittent operation; the minimum storage under such a condition is that which will be necessary for fire demands during the time necessary to return the main source to operation. With allowance for depletion arising from domestic draft during the normal shut-down period, it is usually sufficient to provide for a 1-hr. fire draft. Where, however, the storage is intended to provide part of the fire draft, even with the main service in operation, greater quantity should be provided. The minimum desirable in any service reservoir is a capacity equal to the fire demands for a period of 10 hr. in places over 2,500 population and 5 hr. for smaller places; to this should be added a quantity equal to the peak hourly demands over the normal maximum day.

With further increase in size of service reservoirs various features of reliability of supply are at the same time cared for. Under all but the most exceptional conditions a storage equal to five days' consumption, at a maximum 24-hr. rate, will assure a supply—especially with proper operation to conserve it—during the time required to repair a pump or other essential piece of equipment, or to fix a main pipe line. To offset the hazard of a non-fireproof pumping station, however, storage should equal 10 days' maximum consumption.

* * *

Secondary Chlorination of Water Supply of New York City

BY WILLIAM W. BRUSH
Deputy Chief Engineer, Department of Water Supply, New York City

THE surface water supplies of the city of New York are mainly obtained from the Catskill and Croton watersheds. The existing protection from pollution of these waters is secured by watershed patrolmen, by the city ownership of a small portion of the land bordering on the streams and by the city ownership of all lands bordering on the various reservoirs. The waters are used by bathers in the streams and lakes not owned by the city and there is a population of about 25,000 people on the 375 square miles of the Croton watershed and a winter population of 13,900, and a summer population of 35,500 on the 571 square miles of the Catskill watershed. The purification of the waters is secured by chlorination of part of the water before it enters the main storage reservoirs, by long sedimentation in the storage reservoirs usually represented by several weeks' detention and by chlorination after leaving the main storage reservoirs.

On the Croton watershed there are five small chlorinating plants continuously treating the flow of minor tributary streams whose waters show evidence of pollution. In addition all the Croton supply is treated at Dunwoodie as it flows through the aqueducts. Dunwoodie is located about two miles above the city line. As the Old Croton aqueduct is built in rock tunnel in Manhattan under Amsterdam Ave. between 135th and 140th Sts. and as the sewers are above the hydraulic gradient in the greater part of this section, it has been considered advisable to chlorinate again the Old Croton aqueduct flow as it enters the gatehouse at 135th St. and Amsterdam Ave. and this has been done since 1924. Numerous tests made of the seepage into this tunnel section and of the flow after passing through the tunnel have shown no evidence of pollution in the bacterial content but the menace of possible sewage pollution is ever present.

On the Catskill system the water entering the Ashokan reservoir from Esopus Creek was aerated continuously until the chlorination plant for the outflow from the reservoir was put in use in January, 1925. The Esopus Creek plant will be operated hereafter in the summer vacation season. Besides the chlorination at the Ashokan reservoir at the head of the Catskill aqueduct, all the water flowing from the Kensico reservoir, at the lower end of the main aqueduct, is chlorinated. From this reservoir the water passes through

14 miles of aqueduct to Hillview reservoir. During the present year a plant will be put in to chlorinate the water before it passes from this reservoir into the pressure aqueducts leading into New York City. Reason for chlorinating at both Kensico and Hillview, even though the water is chlorinated as it leaves Ashokan, is that the Kensico reservoir has a tributary drainage area of 22 square miles while the Hillview reservoir is at times subject to pollution from large flocks of seagulls that feed in the polluted waters surrounding New York City.

The dependence on chlorination for the safety of a water supply demands a higher degree of insurance of adequate and absolutely continuous treatment of the water than has been the general practice to date. The use of the excess chlorine control method has been a great aid in determining the safe minimum dose but more attention should be paid to the possibility of drops of water passing the treatment plant either untreated or insufficiently treated. Turbidity means that bacteria may be encased in matter in suspension which is not broken up or penetrated by the chlorine. The delivery of the chlorine is not uniform enough and is not distributed generally in a thorough enough manner to insure at all times sterilization of the entire mass of water treated. Secondary pollution in open reservoirs or in conduits with gradients below the water level in the surrounding soil may occur and must be counteracted by secondary treatment.

Discussion—V. Bernard Siems, water engineer, Baltimore, supplemented Mr. Brush's paper by a review of conditions in Baltimore which give rise to a consideration of secondary chlorination or covering distribution reservoirs. In answer to a call for a show of hands, ten of those in the convention hall indicated that secondary chlorination is being used on their plants.

* * *

Standardization Council and Other Committee Reports

Standardization Council—Since its establishment in 1920, said George W. Fuller, chairman, the Standardization Council has had functioning under it from 15 to 19 subcommittees. The object has been not so much to set up standards as modes of procedure and statements of good practice. Of late the work has centralized on a Manual of American Water-Works, a book of about 550 pages, which will be subject to successive revisions, like the Manual of the American Railway Association. It is expected that the Water-Works Manual will be ready next fall, as also a revised edition of Standard Methods of Water Analysis, a joint effort with the American Public Health Association.

The sub-committee on Boiler Feed Water Studies (Shepherd T. Powell, Baltimore, Md., Chairman) has so large a task in hand that progress reports are all that can be expected for several years. A number of sub-committee reports are summarized below, while elsewhere in this review of the convention certain papers prompted by the Standardization Council are abstracted.

Recent Pumping Station Practice—A 62-p. progress report of the Standardization Council sub-committee on this subject was summarized by the chairman, Leonard A. Day, chief mechanical engineer, St. Louis water-works. In the ensuing discussion there seemed to be general agreement with a statement by J. N. Chester, consulting engineer, Pittsburgh, Pa., that pumps below 2 m.g.d. capacity should be driven either by internal combustion engines or by electric motors. The economy of mechanical stokers for small boiler plants, taking capital charges into account, was seriously questioned by Mr. Chester.

Standardization of Service Pipes—The various materials for services and details of installation were reviewed by James E. Gibson, manager and engineer of water-works, Charleston, S. C. Among new materials for services mention was made of brass and copper pipe, with standard wrought-iron fittings threaded; also soft copper pipe using a flanged bronze coupling without threads. Where galvanized or steel services and lead goosenecks are used the speaker favored placing the corporation cock on top, at an angle of about 45 deg. from the vertical, with the cock extending into the main, say ¼ in. as a minimum, to avoid closure by rust and tuberculation. It is an economic waste, said Mr. Gibson, to place service pipes in the street in advance of paving and of houses to be served. Besides other risks, nine times out of ten something is wrong when the service is needed so the street has to be torn up anyway, entailing not only a second trenching but also lost capital charges between the two jobs. During the extended discussion on this paper there seemed to be a consensus of opinion in favor of making the corporation cock smaller than the service (it is only 5 or 6 in. long, said W. W. Brush) and also in favor of ¾ in. for galvanized and ⅝ in. for lead service pipes.

Watershed Protection — The Committee on Watershed Protection (H. E. Moses, assistant chief engineer, Pennsylvania Department of Health, Harrisburg, chairman) submitted a summary of practice and principles designed to suit the whole country. It was announced that the report had been discussed and approved by the Conference of State Sanitary Engineers that preceded the A.W.W.A. convention. The generally accepted principle now is that no water from a major stream subject to considerable pollution, even though the dilution factor be large, is safe for public use, unless treated in most instances by filtration and chlorination. The tendency seems to be away from preventive measures on the watershed to purification. The "uninhabited" watershed is now more fiction that fact, due to the ubiquity of the automobilist, the fisher, hunter, picnicker and camper. The old first lines of defense by watershed patrol or purchase, and by exclusion or treatment of sewage, are no longer adequate, thus calling for secondary defenses —long-time storage, chlorination and filtration. Generally speaking, purchase of the watershed is not worth while, unless the land is very cheap or there is no other way of controlling dangers. Moreover, it is only a question of time before the vast majority of surface water supplies will require filtration. Even marginal strips are of doubtful value for sanitary protection.

In the general discussion of this report, John A. Foulks, chief engineer, Division of Water, Newark, N. J. [a city which has acquired 70 per cent of its watershed], agreed that the purchase of watersheds under present-day conditions is rarely advisable. He named $15 to $20 an acre as an upset price. W. W. Brush, New York City, said that converting farm lands into parks adds to watershed pollution. William Gore, Toronto, thought the report not strong enough in its advocacy of filtration of surface water supplies. He cited long-standing British practice that requires filtration of all surface waters.

Treating Materials and Supplies — Thomas H. Wiggin, consulting engineer, New York City, chairman of the committee on Testing Water-Works Materials and Supplies, submitted a report which, besides summarizing the standards or specifications already adopted by the A.S.T.M. and other organizations, included proposed new specifications for water-works chemicals, chiefly those used in water treatment.

Essential Statistics—A report on Essential Statistics for Annual Reports of Water-Works, prepared by the committee including George H. Fenkell, Detroit, John N. Chester, Pittsburgh, and others, was submitted and recommended for trial. It is available in pamphlet form and will appear in the Association Manual.

General Standing Committees — Several committees not under the Standardization Council made reports of slight progress only, including committees on meters and brass fittings. For the Committee on Standard Forms of Contract (the chairman, J. Waldo Smith being in Europe) J. M. Goodell, secretary, reported progress in conjunction with the Joint Conference on Standard Construction Contracts which is co-operating with the federal government interdepartmental committees. On Feb. 12 President Coolidge signed an act providing for arbitration on interstate contracts. Three states—New York, New Jersey and Oregon—have statutory law authorizing the insertion of arbitration provisions in contracts. In all other American states, provisions for arbitration in advance of actual disputes are illegal, the English common law of 250 years ago prevailing. This law was recently set aside in England by Parliament.

For the Joint Committee on Electrolysis, composed of representatives of the pipe- and wire-owning utilities working with the U. S. Bureau of Standards, Nicholas S. Hill, Jr., stated that little had been attempted since the comprehensive report of 1921. Lack of progress has been due to the inertia common to such large composite bodies. The Bureau of Standards, while theoretically independent, is as much biased in some ways as the co-operating agencies. There

is reason to hope that some special study that will put life into the joint committee will be undertaken soon.

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Various Papers and Experiences

Landscape Work—Taking as his thesis that it pays "to beautify water-works property," Charles R. Denman, manager water-works, Des Moines, Iowa, described landscape work done by that city at and near its pumping station. Of two borrow pits, one was converted into a lagoon and another, close by the station, into a pool, inclosed by a handsome balustrade. An iris and peony garden was established and trees and shrubs planted. The scheme fits into the Des Moines city planning program. In the discussion of this paper, Dow R. Gwinn, lately president of the Terre Haute Water Co., told of landscape work done by his company that he thought had paid. H. P. Bohmann, superintendent of water-works, Milwaukee, Wis., got moral support, by a show of hands of those in the convention hall, for his opposition to a proposal to place a trade school in the 3½-acre grounds of a new $2,500,000 pumping station—to save the expenditure of money for a trade school site.

Louisville Filter Reconstruction—The reconstruction of a portion of the Louisville filtration plant was described by William H. Lovejoy, superintendent of filtration. The plant was built in 1909 and enlarged in 1914. Because of faulty design, the enlarged portion was used only as a reserve. Among the faults of design were a too narrow pipe gallery, too high wash-water troughs and defects in the rate controllers. The reconstruction work cost $60,000, against first cost (pre-war) of $180,000. Prior to the reconstruction, some of the 1909 bids were speeded up, at times, to a rate of 200 m.g.d. and more, when the river water was in good condition. One of the speeding-up methods was to reduce the sand bed to 8-in. thickness.

Starting a Water-Works Plant—As a help to those who attempt to start water-works in small towns, B. C. Little, superintendent of water-works, Rochester, N. Y., read a paper on "How Jonesboro Built Its Water-Works." The paper was written for the Manual of Water-Works Practice, to specifications by Mr. Fuller. It outlined the growth of a cross-roads settlement to a thriving but still small community and gave the successive steps leading up to a water-works plant, the first of which was a fire that destroyed the chief industry of the town.

Taxation of Water-Works—Relatively few municipally owned water-works pay taxes on their property within their own municipal limits, said H. Carl Wolf, chief engineer, Maryland Public Service Commission, Baltimore, in the course of a lengthy paper on water-works taxation, but a large part of the income of many private companies goes for taxes. In general, the water plants have lighter tax burdens than other utilities. The city-owned water-works of Holyoke, Mass., said Patrick Gear, superintendent, pays the same rate of taxes as do private corporations, while water-works property outside the city pays the local communities at a rate equal to the average rate on the property for the three years prior to its acquirement. At New Bedford, Mass., said S. H. Taylor, superintendent, the water-works is not taxed in the city but is taxed outside it.

Allocation of Sources of Water Supply—British procedure in acquiring water rights for municipal supply was outlined by William Gore, consulting engineer, Toronto, Ont. Compensation in kind is the rule, 43 per cent of the yield being sent downstream. In general, the water authority must supply communities along and near its supply conduit, if demanded. Leonard Metcalf, Boston, stated that studies with Hazen on the problem of an additional water supply for Boston have raised a question as to whether compensation in kind would be advantageous.

Stimulating Activity in Plumbing—The application of the installment plan to the provision of plumbing facilities, especially in small houses, suggested by Frank C. Jordan, secretary of the Indianapolis Water Co. and president of the A.W.W.A., was outlined by the president of a plumbing jobber company which has backed the project and secured the co-operation of both plumbers and banks as well as the use of the plan by many house owners. It is now proposed to extend the plan to other cities. H. F. Blomquist, superintendent of water-works, Cedar Rapids, Iowa, said that under enabling legislation in that state plumbing may be installed at public expense and the cost be collected from the house owner in installments.

Interesting Experiences—One of the sessions was devoted to "The Most Interesting Experiences which I have Recently Encountered in Water-Works Operation." President-elect H. F. Huy, Buffalo, told of a meter that would register in the right direction, hesitate, then go backward. The gears were found to be worn so that the meter would work all right under a light flow but would reverse when the flow became heavy. Mr. Huy also told of cleaning deposits in an intake pipe by introducing blocks of ice at the mouth and passing them inward, the deposit being loosened by the ice and carried forward by the flow of water. A lantern-slide paper by Alexander Milne, superintendent of water-works, St. Caharines, Ont., described a tunnel construction job which saved a large sum as compared with carrying a pipe over a hill.

River Diversion and Flood Control Projects in North Dakota

TWO important hydraulic projects in North Dakota are to be studied by the State Engineer's department as a result of the action of the legislature in appropriating $25,000 for co-operating with the U. S. Geological Survey in making topographic maps to aid in developing flood protection and irrigation projects.

A diversion of the Missouri River is the most ambitious proposition, the first step of which will be the mapping of the Coteau or dividing ridge between the Missouri, Mouse and James rivers. At Garrison, 40 miles northeast of the Missouri, the Mouse River is 200 ft. lower than the former, while the dividing ridge is from 100 to 200 ft. high and 18 to 25 miles wide. It is proposed to divert the Missouri River by a 20-mile tunnel through this ridge to the headwaters of the James and Sheyenne rivers, water diverted to the James River being returned to the Missouri at Yankton, S. D., about 500 miles south. The Sheyenne and Mouse rivers, tributary to the Red River, are included in the Hudson Bay drainage area. The study of this great project is strongly advocated by irrigation engineers of the U. S. Department of Agriculture. The estimated cost of the tunnel is $10,000,000.

The chief object of this diversion would be to assure an ample supply of good water to various cities in eastern North and South Dakota, where the supply is limited and in many cases is strongly alkaline, with a disagreeable odor. The restoration of Devils Lake, the only large body of water in North Dakota, is also being considered. This lake, formerly a source of fish supply and having an area of 100 sq.mi., has shrunk to less than half that size and has turned alkaline, leaving large areas of alkaline flats. The present lake level is 270 ft. lower than the Missouri River. There are also possibilities of gravity irrigation by this tunnel project, serving extensive areas in North and South Dakota which lie in a semi-arid district. However, this development could not be financed as an irrigation project for a number of years. In a discussion of this Missouri River diversion at the recent annual convention of the North Dakota Society of Engineers, the consensus was that with the rapid growth of the cities of eastern North and South Dakota the project will be justified in the near future for municipal water supply alone

Flood protection for Minot, N. D., by the construction of an impounding reservoir, is the main object in mapping the Mouse River valley, but the project includes the storage of water for irrigating 50,000 acres of bottom land. This development has been advised by A. L. Fellows and S. H. McCrory, irrigation engineers of the U. S. Department of Agriculture.

Making Uniform Concrete by Inundating Sand

Practical Device Now Available to Insure Same Amount of Water Regardless of Moisture in Sand

By R. L. Bertin

Chief Engineer, White Construction Co., New York City

NUMEROUS tests have demonstrated the fact that the control of the water content in concrete is an important factor, if not the most important factor, in maintaining the strength of concrete uniform. Given an aggregate suitable for concrete, the proper proportions may be determined by several of the numerous methods now in vogue and the optimum water content determined. It is a further fact that commercial sand as stored and used on the ordinary concrete job contains water which may vary in amount from nothing to 6 per cent of the sand by weight, depending upon the storage conditions and the exposure to the elements. This contained water becomes a considerable part of the total mixing water and therefore should be measured as a part of the total amount of water to produce concrete of the required quality if the total water content of the batch is to be constant. Besides, it is well established that the bulk of the sand changes materially with the amount of moisture it contains. The apparent amount of sand therefore contained in a measure filled loosely from the stockpiles is not an actual indication of the true amount of sand the measure contains. The variation in the amount of sand used in a batch affects the quantity of concrete produced, its workability and strength, and the control of this variation as well as that of the water is essential to the production of constant concrete.

Some years ago, G. E. Escher, president of the White Construction Co., and the writer in investigating this question came to the conclusion that the difficulty in

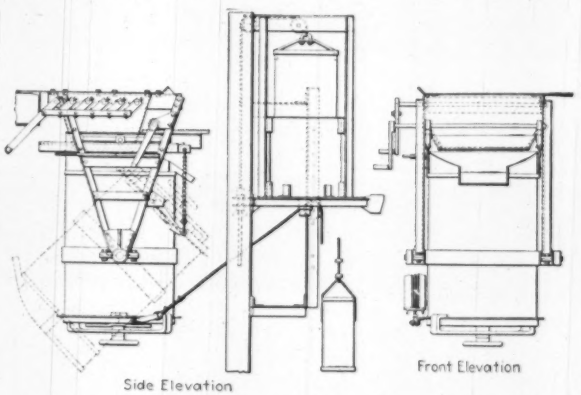


FIG. 1—DETAIL OF INUNDATOR FOR MEASURING SAND FOR CONCRETE

accurately measuring sand and the water it contains might be obviated to a considerable degree by measuring the sand in a saturated condition. In saturating the sand, the film of water covering either partly or wholly the particles of sand is destroyed and the particles allowed to arrange themselves under water as they would in air were they dry, so that the compactness of the mass is no longer a function of the moisture content of the sand and the amount of water held by the sand is thereby made constant. In carrying out this principle there was devised the inundation method of measuring sand.

This method was described by the writer before the 1922 convention of the American Society for Testing

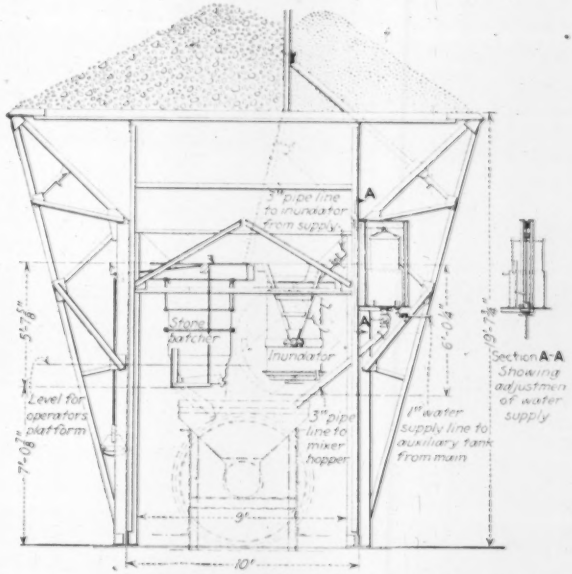


FIG. 2—INUNDATOR MOUNTED ON AGGREGATE STORAGE AND MEASURING PLANT
Inundator as manufactured by Blaw-Knox Co.

Materials and in an article in *Engineering News-Record*, June 22, 1922. It has also been the subject of a thorough investigation by the Bureau of Standards which was reported in a paper by W. A. Slater and G. A. Smith at the American Concrete Institute convention in 1923 and published in the *Proceedings* of that Institute for that year.

The apparatus used in the application of this method has now been perfected and is commercially on the market. It is known as the inundator and is shown in detail in the accompanying illustrations. Basically this inundator consists of a container with an adjustable bottom and an excess measuring tank to hold water. Both containers are made adjustable so that the capacity of either may be changed at will. It is mounted on pivoted arms just under the sand bin and dumps its sand content directly into the concrete mixer. Fig. 1 shows the detail of the inundator itself and Fig. 2 its installation in a storage and measuring plant.

As shown in Fig. 1, the inundator or tank has an adjustable bottom whereby the content may be adjusted to fit the calibration as described hereinafter. At the bin bottom, which is at the top of the inundator, there is a movable screen operated by a crank which sifts the sand into a small hopper leading into the inundator, the top of which is equipped with a strike-off gate at the bottom of the small hopper. In operation the workman shakes the sand from the bin, thereby permitting it to sift down into the tank which has been filled about one-third full of water, the amount being only sufficient so that it will overflow when the tank is filled with sand, until such time as the sand shows up at the top of the tank, when the strike-off gate is closed. The tank is thus completely filled with inundated sand and

a release trip is thrown and the tank overturns from top-heaviness, dumping automatically into the mixer; when it is empty it becomes bottom-heavy and returns to its original position. Alongside of the inundator in the equipment shown is an automatic measuring tank which is set to contain the amount of water predetermined from an analysis of the mixture and which discharges directly into the mixer. In the full equipment shown, a stone batcher of familiar type is also placed to measure accurately the discharge from the stone compartment of the overhead bin.

In calibrating the inundator preliminary tests should be made to determine the actual weight of sand and water held in a given volume of inundated sand, these amounts varying slightly with different sands. The sand container is then adjusted for the number of cubic feet of sand required for a batch based on the results

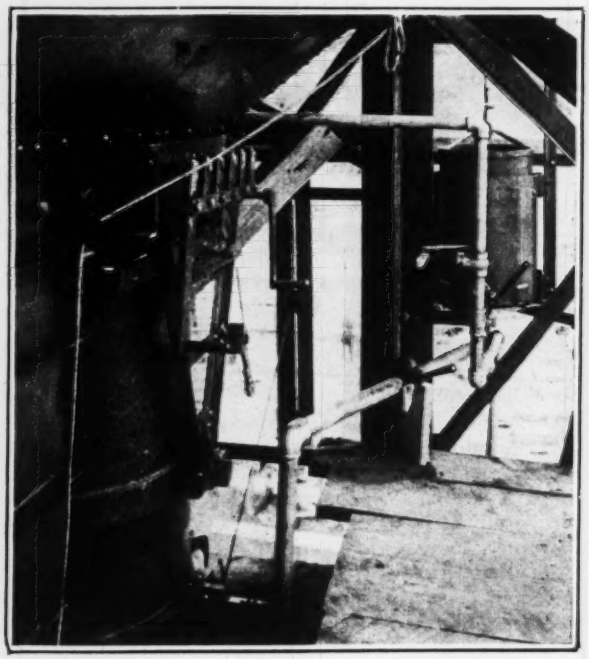


FIG. 3—CLOSE-UP VIEW OF SAND INUNDATOR
In use by Turner Construction Co. on concrete stadium, University of Pittsburgh.

of the above-mentioned test. The amount of water held by that amount of inundated sand is computed. The difference between the total amount of water required for the batch based on the water ratio desired and that held by the sand and stone is the amount for which the excess water tank is to be adjusted. The amount of sand and water which the inundator will then deliver to the mixer will be constant from batch to batch as long as the characteristics of the materials as to grading remain constant. Any change in the quality of the concrete, such as a radical change of its consistency or a tendency to segregate, indicates a change in grading characteristics of the aggregate, and a change of proportions should then be made to correct the condition by either changing the quantity of sand or stone or both but maintaining the quantity of water constant, thereby obtaining the required workability without affecting the strength or quality.

The Blaw-Knox Co., of Pittsburgh, has been licensed by the patentee for the distribution of the inundator. The equipment has been used for the past two years by the White Construction Co. on most of its work and is now in operation in the construction of the new stadium for the University of Pittsburgh, at Pittsburgh, Pa., which is being built by the Turner Construction Co. It has been found there that a complete cycle of inundation, including the measuring out of the stone, takes 45 sec. or less, which is a shorter period than the concrete is in the mixer, showing that the operation does not slow up the concreting operations.

Natural Vibration Period of Tires Is Cause of Corrugations

Front Tires With Natural Vibration Period Different From Rear Tires Is Remedy for Road Corrugations

By Robert J. Walker
Lieutenant, U. S. Navy, Washington, D. C.

SOME force which has a certain definite period must be acting on our gravel and bituminous roads to cause them to become corrugated so easily and so evenly. The gravel road between Washington, D. C., and Annapolis, Md., is taken as a typical example by the writer, as he has made numerous trips over it at various times of the year under all kinds of weather conditions.

The critical speed on this road varies from 20 to 30 miles an hour. By critical speed is meant that speed which gives the maximum vibration to the car while traveling over the corrugations. Speeds well above the critical, say 40 miles per hour, and well below it result in very little if any vibration in the car. It was also noted that the critical speed was greater on straightaway stretches than near and around curves. As this critical speed is practically that speed at which normal traffic moves over the road, the corrugations must be caused by some part of the car which has a constant natural vibration period. This period must also be common to the majority of cars.

A car traveling over this road at 25 miles per hour with the crests of the corrugation 31 in. apart (the mean distance between crests as observed by the U. S. Bureau of Public Roads) would vibrate (up and down again) once every 0.07 second:

$$t = \frac{31 \times 60 \times 60}{25 \times 5{,}280 \times 12} = 0.07 \text{ second}$$

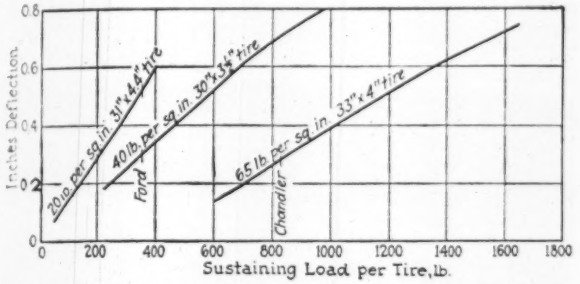
The springs of the average car have a natural period of vibration of 0.9 of second. With such a comparatively long period it would be impossible for the springs to have any effect on the roads. The periods for engine firing impulses for six- and four-cylinder cars traveling at this speed (25 m.p.h.) are about 0.006 and 0.009 second respectively. With such short periods it would be impossible for the engine impulses or vibrations to effect the road bed. Let us study the tires of a car, treating them as loaded springs and finding their natural periods of vibration:

$$t = \pi \sqrt{\frac{f}{12g}}$$

where t = time in seconds for one complete vibration (up and down) for a loaded spring, f = deflection of the spring in inches, and g = 32.2 ft. acceleration due to gravity.

A Chandler car with two people in it weighs approximately 3,300 lb. It uses 33x4-in. tires which under normal conditions are inflated to 60 lb. per square inch

Referring to the graph, it is noted that these tires will have a deflection of 0.28 in. for a weight of 825 lb. per wheel. For a Ford car which carries 30x3½-in. tires and weighs about 1,400 lb. (350 lb. per wheel) with two people there will be a deflection of about 0.29 in. The curves on this graph are plotted for theoretical tires of the above sizes disregarding any bulging which takes place upon compressions.



GRAPH ILLUSTRATING TIRE DEFLECTION CURVES

Taking the deflection of the tires for the first car we get a period of

$$t = \pi\sqrt{\frac{0.28}{12\times 32.2}} = \pi\sqrt{\frac{2.8}{3{,}865}} = \pi\,\frac{1.67}{62.1} = 0.0846 \text{ second.}$$

For the second car we get

$$t = \pi\sqrt{\frac{0.29}{12\times 32.2}} = \pi\sqrt{\frac{2.9}{3{,}865}} = \frac{\pi 1.7}{62.1} = 0.0866 \text{ second.}$$

If we assume 25 miles per hour for the heavy car we will get the following distance between crests:

$$\frac{25\times 5{,}280\times 12\times 0.0846}{60\times 60} = 37 \text{ in.}$$

Assuming 25 miles per hour for the light car we will get

$$\frac{22\times 5{,}280\times 12\times 0.0866}{60\times 60} \text{ in.} = 37.9 \text{ in.}$$

between crests. These figures are about 12 per cent too high for the average found from the road observations made by the U. S. Bureau of Public Roads. Undoubtedly this error is due to the graphs being made on the assumption that the tires do not bulge when they are deflected. If we consider this bulging effect the supporting areas will increase more rapidly with given deflections; therefore the deflections for the same sustaining loads will be less and the natural periods of vibration less, bringing the distances between crests exactly into coincidence with those observed.

Due to the lack of ready information on other types of cars, curves have not been shown and natural tire periods compared. However, noting that these two widely different types of cars have practically the same tire vibration periods and when traveling at a normal rate of speed they synchronize with the corrugations of the road, there is no doubt but that these road corrugations are formed entirely by the pounding action of the tires themselves.

The Public Roads Bureau has observed the fact that corrugations are never found on steep hills. The theory advanced that these corrugations are caused by the kick-back of surface material arising from the spin of one or both wheels seems highly improbable. If this were so it seems only natural that corrugations would be found on steep hills where the tractive force and the tendency for wheel spin is much greater.

The reason that corrugations are noted in the road just the other side of a bump is the fact that the tire in passing over that bump has been set in vibration, causing it to pound out a corrugated surface in the road as the car progresses.

The following figures give us the period of a 31x4.4-in. balloon tire. The deflection is taken from the graph for a loading equal to that of a Ford.

$$t = \sqrt{\frac{0.51}{12\times 32.2}} = 0.114 \text{ second.}$$

As the curves on this graph do not account for the bulging effect of the tire this figure should be decreased about 12 per cent, which would make it about 0.102 second. For a speed of 25 miles an hour this will give corrugation crests

$$\frac{25\times 5{,}280\times 12\times 0.102}{60\times 60} \text{ in.} = 44.8 \text{ in.}$$

apart.

The time undoubtedly will soon arrive when fifty per cent of our cars will be equipped with balloon tires. At this time we may expect the corrugation troubles of our roads to disappear. However, when the balloon tires predominate this corrugation will reappear with average crests about 44.8 in. apart instead of 31 in. apart as at present.

The problem of preventing road corrugations for all future time undoubtedly rests in the hands of our states road commissioners. If they would require the front wheels of our cars to be equipped with tires having an entirely different natural period of vibration from the rear wheels our corrugated road troubles would be solved. For example, if the front wheels of a Ford were equipped with standard 30x3½-in. tires and the rear wheels equipped with 31x4.4-in. balloon tires, the rear wheels would pound down the crests tending to be formed by the front wheels, and in so doing would keep the road surface level and free from corrugations.

More Tub Filters Being Built at York, Pa.

Rapid sand filters of the old tub sort are being added to the installation of that type constructed for the water-works of York, Pa., in 1899 and added to in 1908 and 1920. The six 0.5-m.g.d. units now under construction will complete the program adopted by the York Water Co. 25 years ago. The existing filters yield water of satisfactory quality at a moderate operating expense and filters of the same type could be added in the existing filter house at much less cost than would be required for new sedimentation basins and a head house for rectangular concrete filters, states C. A. Emerson, Jr., of Fuller & McClintock, engineers for the improvements. When the capacity of the enlarged filter plant is reached the company proposes to put in a high-velocity-wash rapid sand plant, which will be extended gradually to take over the load on the tub filters as they reach the end of their usefulness. The old tub units are of the two-story Jewell type, and are equipped with mechanical agitators, Weston rate controllers and Dibble water-level indicators. Although the older units show some deterioration they are apparently good for at least ten years' more service with moderate expenditure for overhauling. The new tub units are of the same general type as the old, of Roberts make, have 30 in. of sand on 15 in. of graded gravel, perforated wrought-iron laterals, loss-of-head gages and Simplex-venturi rate controllers. Venturi meters are being installed on each of the 20-in. supply mains leading to the city.

Some Engineering Aspects of a Toll Bridge Project

Realization of Bear Mountain Bridge the Result of Strategic Location and Low Cost Due to Unusual Site

By H. H. Sherwin
President, H. H. Sherwin & Co., Inc., New York City

VIEWED as a traffic improvement meeting important public needs, the recently completed Bear Mountain bridge across the Hudson River has some interesting aspects in its bearing on efforts to meet the numerous large bridge problems arising out of present-day highway traffic needs. They are briefly noted in the following, drawn from the writer's personal connection with the conception of the project and the construction of the bridge as vice-president and general manager of the Terry & Tench Co.

The project is unique as a large public improvement initiated and carried out by private enterprise. It makes the first break in the Hudson River barrier to highway communication east and west below Albany. At the same time its very possibility is founded in certain peculiar conditions of location, and its conception arose from a remarkable series of circumstances.

Origin of Project—In 1920-21, while the suspension bridge over Rondout Creek at Kingston was being built for the New York State Highway Department, public interest was attracted to a project for crossing the Hudson near Yonkers by a pontoon bridge with drawspan to accommodate the growing automobile traffic between the banks of the river (see *Engineering News-Record* Aug. 4 and 11, 1921, pp. 207, 244). From a practical standpoint this proposal seemed to the writer to have several undesirable elements, and the thought gradually took form that a bridge might be built at some point along the lower Hudson that would give a practical solution of the crossing question within reasonable cost limits.

Examination of topographical maps indicated that any bridge project below Peekskill would be difficult of accomplishment on account of the expense involved in long spans and deep foundations. On the other hand, there seemed to be several possibilities through the Hudson Highlands between Peekskill and Newburgh, the most promising of which was a few miles north of Peekskill. A field examination of this section developed the site on which the bridge was built. At this site, it happens, state park lands occupy both banks.

It was some time after the site was chosen before it was discovered that a railroad bridge had been projected at this point, some thirty or forty years before, and that a considerable amount of work had been done thereon, including the relocation of the West Shore R.R. tracks to expose a satisfactory foundation site on the west bank of the river. Some unextinguished rights of the old company survived; by purchasing these it became possible to locate the bridge approaches wholly on state land, with a few minor exceptions.

Traffic Service—When this general site was under discussion, and after a study had been made of the traffic possibilities, it became apparent that a bridge at this site would serve not merely local but also extensive long-distance traffic needs. The chief local service was to give an all-year all-land route for pleasure and commercial traffic from the New York City district to Bear Mountain Park and the Catskills. But the bridge would also give New York City, Westchester County, and Lower New England, access to through routes leading west, by way of the state highway system through Goshen and Middletown to cities in northern and western New York. Further, it would provide a direct route from lower New England to Delaware Water Gap and the Pocono Mountains, and in the opposite direction from Scranton and Wilkes-Barre to the Berkshires and the Sound resorts; and it would connect points as far south as Philadelphia and Atlantic City with points in lower New England by a route avoiding the congestion in the metropolitan zone. Estimates of traffic and of cost of construction indicated that the project would pay as a commercial proposition.

Type of Bridge—After the general site of the bridge was determined upon, core borings were taken to develop foundation conditions. These showed sound rock on both shores, but sloping down from the water's edge towards the center of the river on a 1:1 slope. The rock of the west bank sloped up steeply to the 150-ft. level, where the ground was approximately level, while on the east bank the rock sloped up just as steeply to a narrow shelf at the 170-ft. level, and thence again to the 900-ft. elevation. The water in the channel of the river was more than 100 ft. deep, and the rock in the central part of the river was overlain by heavy blue clay, such as is used for brickmaking in the Hudson

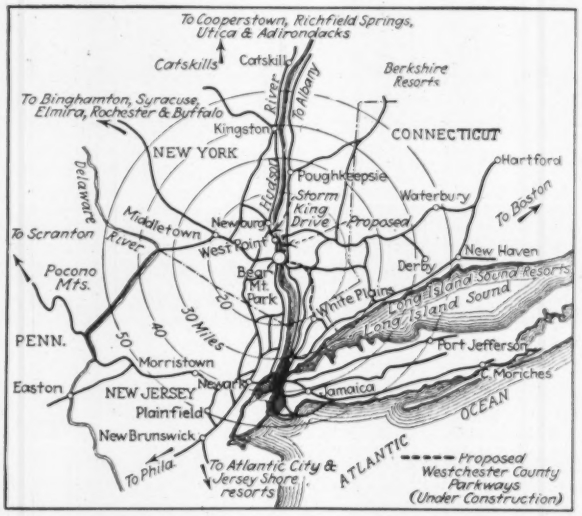


FIG. 1—STRATEGIC LOCATION OF BEAR MOUNTAIN BRIDGE
Main automobile through routes are indicated. There is no other highway bridge below Albany.

Valley. These conditions practically dictated a clear span over the river and a high-level crossing.

The span length (about 1,600 ft.) and the clearance requirements of the government, together with the property rights of the New York Central and West Shore Railroads, fixed the type as either cantilever or suspension. The cantilever type was at a disadvantage, as the channel of the river is very close to the east bank and full clearance was required over this channel. The suspension type was selected on account of the natural anchorages that were to be had for the cables, the smaller construction hazard of this type as compared with the cantilever type, the satisfactory comparative estimates of cost, and superior appearance

Other Features—In the charter of the bridge company a 20-ft. roadway was required as a minimum. The actual roadway width was fixed by structural requirements, rather than by the traffic demands. It was not considered satisfactory to exceed a ratio of 1:30

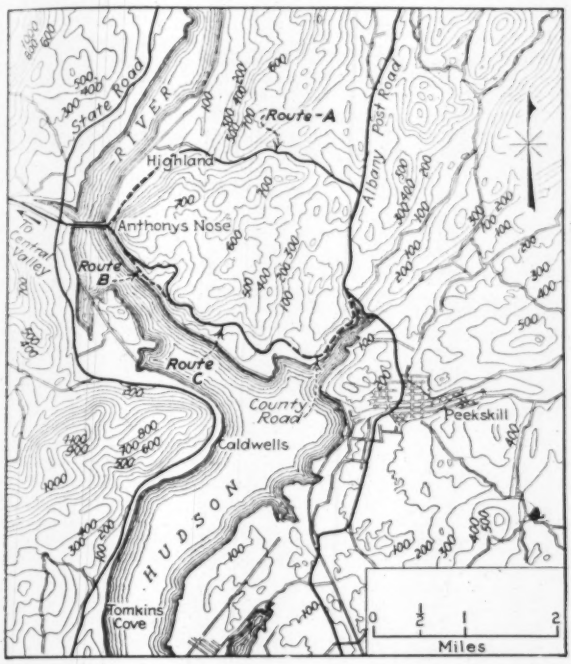


FIG. 2—TOPOGRAPHIC FEATURES OF LOCATION
Alternative routes of east approach

for depth as compared to length of wind trusses in the central span. This fixed the spacing of the stiffening trusses at 55 ft. and provided more than enough space for a roadway to accommodate four lines of travel together with two 5-ft. sidewalks.

The comparative narrowness of the central span also made it desirable to space the cables so that the hangers would fall outside of the stiffening trusses, using transverse girders for the support of the stiffening trusses. This not only gave a satisfactory design from a structural and maintenance standpoint, but simplified the erection, as the cross-girders attached to the hangers served as falsework upon which the stiffening trusses and other material in the central span could be easily and quickly erected. It also put the hanger connection adjacent to the posts of the trusses, where a power arrangement could be easily applied for adjustments, as against having this connection made at the posts, where the hanger connection would be more difficult.

One other item in connection with the bridge deserves special mention. The specifications for the fabrication of the towers provided that the sections between horizontal field splices should be shop-assembled to the extent of three full sections on each leg before the lower section of this combination could be shipped. Thereafter as a top section was added a lower section could be shipped. The holes for field rivets were reamed to full size in connection with this operation, so that from a practical standpoint the towers were erected and checked for accuracy of workmanship at the shop. The result of this was that there was no reaming of rivet holes in the field and that no shims whatever were used in the horizontal splices. Each tower leg was so plumb during erection that a transit line on the face did not depart appreciably from a true line from top to bottom.

Approaches—An unusually difficult problem lay in the east approach (that on the west presented no unusual features). The natural connection between the bridge and the Albany Post Road appeared to be in a northeasterly direction over the existing road leading from Manitou to the Post Road (Route A in Fig. 2). On this route there would have been practically no railroad hazard to contend with during construction, the distance from Peekskill to the bridge would not have been substantially different, and the cost would have been less, and easier to estimate accurately. The approach would not have had the scenic value of the route finally adopted, and the amount of rise and fall between Peekskill and the bridgehead would have been considerably greater. Irrespective of these considerations, sufficient opposition developed to this route so that the charter specified another location (the one built), running south parallel with the river about 3 mi. to a connection with the county road along Annsville Creek, leading to Roa Hook.

When topographical surveys were later made, several alternate locations on this route were compared. The southerly 1½ mi. was fixed within narrow limits by the topography and presented no unusual features. In the northerly half mile there were no particular controlling features. The principal problems were found in the one-mile distance between these sections, where a small mountain stream which intersects the route separates Anthony's Nose Mountain (on the north) from the so-called Manitou Hills.

Various detail locations here were ultimately reduced to two as shown: Route B, running roughly parallel to the river, at about the 300-ft. level; and Route C, the one adopted, running from the bridgehead south on the maximum gradient of 7 per cent to the 400-ft. elevation at a point about 4,000 ft. south of the bridge, thence turning east along the face of Anthony's Nose until the valley of the mountain stream could be crossed "on the country," and finally returning to follow the topography parallel to the river.

Route B was advantageous from the standpoint of grades and distance but involved heavy work in uncertain material adjacent to the railroad on either side of the mountain stream. Route C was adopted chiefly on account of the lesser amount of work adjacent to the railroad and to avoid the uncertain material above mentioned, which consisted of disintegrated rock cliffs almost overhanging the railroad in some places.

The construction of the approaches presented no unusual features that would not ordinarily be encountered in rough country, outside of precautions that were necessary by reason of proximity to the New York Central R.R. and the fact that the construction contract put upon the contractor the responsibility for location of the road along the above-mentioned general route, subject to the approval of the bridge company's representatives. All line and grade work, both on the bridge and on the road, was also done by contractor's forces.

Final—It should be borne in mined that the surprisingly low cost of this Hudson River crossing is due largely to the fact that the property, foundation and anchorage charges were comparatively nominal, due to the peculiar conditions existing at this location.

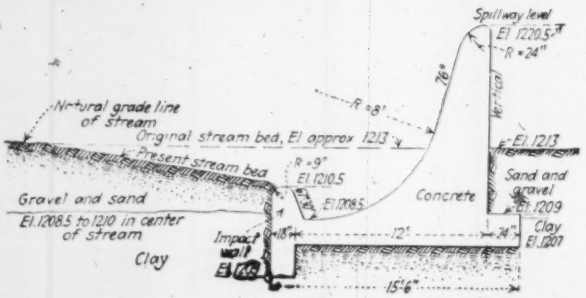
Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Scour Below Dam Prevented By Special Toe Construction

Sir—Your editorial comment on the article of A. F. Meyer in the issue of April 9, p. 587, expressing regret that Mr. Meyer failed to give specific examples of toe scour, is hardly well founded as such cases have come to the notice of all of us who have given the matter any study. The point to be regretted in Mr. Meyer's article would seem to be his failure to cite and illustrate specific cases wherein his treatment of the problem had eliminated the trouble.

A dam constructed by Proctor K. Clarke for the Landreth Production Co. across Hubbard Creek near Ibex, Tex., built according to the principles laid down by Mr. Meyer (see



LANDRETH DAM OVER MAIN HUBBARD CREEK; SCOUR PREVENTED BY TOE CONSTRUCTION

drawing herewith) has been in service since 1923 and the loose gravel in front of the toe wall shows no sign of scour.

It will be noted that this dam was designed to form a small channel reservoir in a stream that is subject to very great periodic floods. At the site selected the bed of the stream consists of about 4 ft. of loose gravel on a bed of medium hard clay. The bottom of the "bucket" was placed 4½ ft. below the natural bed of the stream, and the top of its downstream rim, or the "impact wall," was placed 2½ ft. below this natural level. The behavior of this spillway has been perfect and the gravel bar below the dam has assumed approximately the position shown, that is, a gentle and uniform slope from the top of the downstream rim of the "bucket" up to the natural bed of the stream.

The first cost of this type of spillway is not greatly in excess of the cost where no provision is made to protect the stream bed from scour, and it is certainly not as great as the final outlay that is usually made by repeatedly dumping rock or placing concrete below the dam until nature builds up a protective wall and basin. In other words, the laws of hydraulics require that the velocity of the falling water be checked, and if provision is not made in the design of the dam it will be demanded in the way of repairs.

Albany, Tex., JAMES H. PIRIE.
April 14, 1925.

Reverse Pressure in Oil Tanks Source of Danger

Sir—In your issue of April 16, 1925, p. 638, there is a description of the failure of two large oil tanks which was followed by a fire that doubtless obscured somewhat the cause of the failure.

The conditions surrounding this failure are so much like conditions that existed in a failure where I was called in to determine the cause and devise means of restoring the tank that it seems to me the causes of the failures are identical.

In the failure which I examined, a large tank, not quite so large as these 80,000-bbl. tanks, was made with a bottle-tight roof, as these were made. Vents had not been provided to take care of the varying volume and pressure of the air and oil vapors in the tank. The tank, 30 ft. high, had a gasoline content less than one-third of its capacity. In the day time the sun beating on the shell and roof warmed up the inside of the tank. Not only did this heat expand the large volume of air in the tank, but it also evaporated some of the gasoline. When the gage hatches or manholes were opened, the surplus gas would escape. In the night the temperature dropped. It was spring season and the nights were chilly. This drop in temperature not only reduced the pressure of the air in the tank but also condensed the gasoline vapor. This caused a partial vacuum in the tank which was enough to suck in the entire roof, which was coned 8 ft. at the middle, and reverse the cone, breaking all of the 19 posts supporting the roof.

The roof was of excellent design and capable of supporting with perfect safety 40 or 50 lb. per sq. ft. of load on its entire surface. But one pound of negative air pressure would mean 144 lb. of load on the roof.

As illustrating the effect of gasoline vapor in a container condensing and producing a vacuum, I left a ten-gallon gasoline can in the country over winter. It had some gasoline in it. The next spring the sides of the can were found to be caved in very badly.

I am convinced that the cause of the failure of the two tanks described in your recent issue is the same as that of the one I examined. The shock of the one that gave way first probably set off the other.

I believe that the tank which failed first is the one that was only partially filled with oil. Either the vent pipe was plugged up or closed off or it was not of sufficient capacity to take care of the large inrush of air resulting from the drop of more than 60 deg. in temperature. This resulted in the roof being sucked in; a spark from the steel created an explosion, and this explosion by its shock jarred the next tank and broke the welded connection of shell to bottom. This caused that tank to fail and lose its content of oil.

Vent pipes have been known to be closed to save the vapor that is lost through the "breathing" in the vents. It would be easy for this vent pipe, if it is not designed against such contingency, to be clogged with leaves or other matter.

The description of the failure states that the tank which is not supposed to have failed first had its "entire upper portion and roof warped and crumpled to the inside, leaving only two or three rings standing." This is exactly what would be expected if the tank had failed because of external air pressure.

I do not believe that a riveted tank would have been disturbed by a shock such as this, but it is easy to imagine brittle welded joints to be broken by such means. I have found welded joints to be easy to pry apart. They do not have a toughness that approaches that of a riveted detail.

There are two lessons that can be drawn from this failure. One is the importance of extra precaution against even a few ounces of external air pressure on a tank. This is best accomplished by use of duplicate breathing valves on the top of the tank.

The other lesson is the brittleness of welded edge joints.

Pittsburgh, Pa., EDWARD GODFREY.
April 25, 1925.

New Vehicular Subways for London

The first of a series of vehicular traffic subways to relieve traffic congestion in the fashionable quarter of London is proposed between Berkeley St. and the Mall. Berkeley St. is one of the most used streets in London owing to the fact that it provides access to Mayfair for a large number of private automobiles and business cars. In the present state of affairs, traffic jams and hold-ups are becoming increasingly serious where Berkeley St. joins Piccadilly. This scheme is looked upon as the only practicable one for relieving traffic congestion in the West End, and the proposal to afford additional relief by undermining the roadways in Trafalgar Square to provide an underground motor route has been abandoned on account of the network of tube railways in that area.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

News Brevities

Land Acquired by the State of New York for river regulation by means of storage reservoirs is to be assessed and taxed in the same way as wild and forest land within the State Forest Preserve, in accordance with an amendment to the tax laws of New York recently signed by Governor Smith. Such taxes as are levied under the new legislation (Chap. 390, Laws of New York, 1925) are to be paid by the river regulating district under whose authority the land was acquired.

Reconstruction of the Gay St. Cantilever bridge over the Tennessee River at Knoxville, Tenn., in order to widen it, is being considered by the director of public works. The bridge was built about 30 years ago. Charles Evan Fowler, the designer of the bridge, has been retained by the city to report upon the work.

A Chair of Building Science and Art is to be established at the University of Cambridge, another at the University of Manchester, and a possible third at Bristol University, according to a report coming from Great Britain. British engineers hope that these chairs will be occupied not by architects but by scientists.

Bonds to the Amount of $1,100,000 have been authorized by the City Council of Fort Collins, Colo., for the purpose of extending its water-supply system. The work will include improving the filtration plant, enlarging the storage facilities, and replacing piping, etc.

The State of Utah and the Bureau of Reclamation jointly have entered into a contract providing for the continuance of the investigation of the Salt Lake Basin project. The expense will be borne equally by the federal government and the state.

The Milwaukee Civic Center Ordinance, passed by the City Council six years ago, was repealed April 7 on a referendum vote by a majority of nearly 10,000. The ordinance was a preliminary step to the group plan of public buildings.

A Bill to Give Engineers a professional standing, recently introduced in the legislature of Saskatchewan, Canada, has been defeated by a large majority in the committee to which it was referred.

Possibilities of Joint sewage disposal for East Chicago, Hammond and Whiting, Ind., are to be reported on by the Randolph-Perkins Co., Chicago.

Engineering Fifty Years Ago

From *Engineering News*, May, 1875

NOTES on Building Materials—MacAdam did not employ a rough pavement for the foundation of his broken stone, and however convenient it may be to apply the term "macadamising," it does not properly attach to roads so formed and covered with broken stone.

* * * *

In making concrete, it is preferable, instead of employing one part of ground lime to six parts of ballast, gravel or burnt clay, to use one of ground lime, five of ballast and one of sand.

Concrete is generally more or less porous, readily passing water in wet soil, in which it requires careful drainage.

Major W. H. Wiley Dies

W. H. Wiley, the head of the firm of John Wiley & Sons, Inc., publishers of technical and scientific books, died at his residence in East Orange, N. J., on May 1, in his 83rd year. Mr. Wiley was born in New York City and was graduated from the College of the City of New York in 1861, at which time he joined the New York Volunteers, later known as the famous 7th Regiment. For four years he fought in the Civil War, advancing to the commission of major of artillery. After the War he entered Rensselaer Polytechnic Institute from which he received an engineering degree in 1866 and followed with a year's work in the Columbia School of Mines. He had several years' engineering experience in the Brooklyn water-works, the New York City water-works, and the Philadelphia & Reading R.R., until 1875 when he entered the publishing house founded by his grandfather, Charles Wiley, in 1807. For 50 years he had been connected with that house, at the same time keeping close contact with the engineering profession largely through its various societies. He was one of the oldest living members of the American Society of Civil Engineers, having joined in 1869. For a number of years he had been treasurer of the American Society of Mechanical Engineers. For three terms he was a representative in Congress from the 8th New Jersey District.

Railroad Terminal Proposed for Pueblo, Colo.

The Pueblo Terminal Railway Co. has been incorporated in Colorado and plans to erect a $4,000,000 railroad terminal in the city of Pueblo, Colo.

State Sanitary Engineers Meet Just Before A.W.W.A.

Instead of holding their annual conference at the same time and place as the State health officers, as heretofore, the State Sanitary Engineers met at Louisville, Ky., on April 25 and 27, just before the convention of the American Water Works Association settled down to work. The plan worked so well that subject to the final decision of the executive committee the conference will be held in Buffalo, N. Y., next year, on the Monday and Tuesday of the A.W.W.A. convention.

There was a long program of papers and reports on the sanitary control of water, milk and oyster supplies, bathing places, sewage disposal and stream pollution, mosquitos and malaria and waste disposal.

The committee on Ground Water Supplies submitted a final report, the adoption of which marked a new stage in the progress of the organization, which hopes to close one or two investigations each year hereafter. The report includes a code of principles which will be printed in a later issue of this journal.

Officers for 1925-26 are: Chairman, Richard Messer, engineer Virginia Board of Health, Richmond; vice-chairman, F. C. Dugan, engineer Kentucky Board of Health, Louisville; secretary-treasurer, A. P. Miller, sanitary engineer U. S. Public Health Service.

A.S.T.M. To Honor Dudley and Marburg

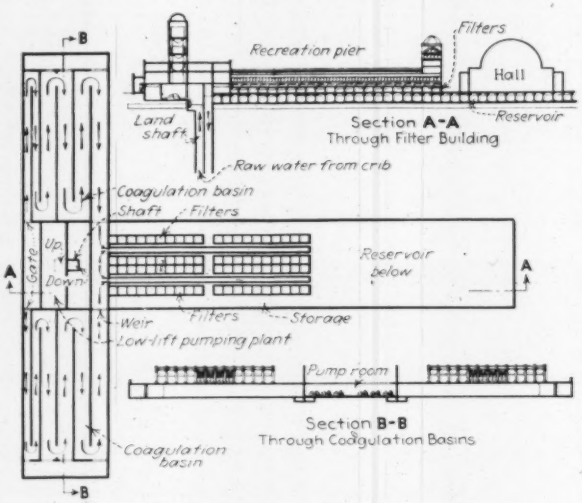
Announcement has been made by the American Society for Testing Materials that the executive committee is to recommend to the society, at the annual meeting next June, that there be established the Charles B. Dudley medal and the Edgar Marburg lecture in honor of the late president and late secretary of the society. It is proposed that the Dudley medal, in honor of Charles B. Dudley, who was president of the American Society for Testing Materials from 1902 to 1909, be awarded to the author of a paper of outstanding merit presented before the society constituting an original contribution on research in materials. The lecture shall commemorate the name of Edgar Marburg who was secretary from 1902 until his death in 1918. The lecture is intended to afford an opportunity for the society to be addressed by leaders in the field of engineering materials who will present to the society outstanding developments in the promotion of knowledge of engineering materials. It shall carry with it an honorarium of $200 and a suitably engraved certificate. Six thousand dollars is required and it is expected the funds will be contributed by the members of the society.

Filtration Plants for Chicago Water Proposed

City Engineer Plans Five Plants on Lake Shore Over Intake Tunnels —Superstructures to be Used as Recreation Piers— Total Cost Estimated to be $40,000,000

THAT filtration of the water supply of Chicago is rapidly becoming an important problem, irrespective of the plans of the Sanitary District for extensive sewage treatment works, is urged in a recent report to the commissioner of public works by John Ericson, city engineer, who has submitted plans for experimental and permanent filter plants.

This report, which deals with the problem of quality of the city's water supply, points out that owing to the raw water gradually becoming more unsatisfactory the doses of chlorine have had to be increased until at times the water has a very objectionable taste which is the cause of much unfavorable comment from the consumers. In 1923, the amount of chlorine used was about 673,000 lb., but in 1924 this was increased to nearly double the amount, or 1,250,690 lb. As moist free chlorine has a destructive effect upon metals the dosed water will in time produce a serious situation in the maintenance of the city's water works machinery.



TYPICAL FILTER PLANT FOR CHICAGO

Since the present city administration is disposed favorably to universal metering, which is a necessary prerequisite to filtration, Mr. Ericson deputed Loran D. Gayton, engineer of water works design, to make a preliminary study of sites for filter plants. It was found that much of the suitable property adjacent to the pumping stations has been covered with costly buildings and property values are such as to prohibit acquisition of the extensive areas required. An alternative location is on the lake shore at points where the intake or lake sections of the water tunnels connect with the shore sections. This arrangement would involve the use of park property but in order to reduce this area to a minimum, Mr. Ericson proposes to locate a part of the structure within the lake and to utilize a part of the upper deck as a recreation pier.

In the typical design, shown by the accompanying drawing, the plant is of T-shape, with its head on the shore and its stem extending into the lake. At each end of the head would be coagulating chambers, with a pump room between them and having a double shaft to the tunnels. Lake water from the intake tunnel would be treated and delivered to the coagulating basins, from which it would flow to the filters in the stem of the T and thence to the storage reservoir at the farther end. Clear water would return through conduits under the filters to a down shaft connecting with the land tunnel, for gravity flow to the pumping stations of the distribution system.

Five filtration plants are proposed, serving the five main groups of tunnels which lead from the intake cribs to the shore and then branch out to the several pumping stations in each tunnel district. The approximate locations would be at Wilson Ave., Chicago Ave., 12th St., 68th St. and 73rd St. Modifications of the general design would be made to suit the conditions at each location. As a preliminary it is considered advisable to have an experimental filter plant built and operated for at least a year for the purpose of determining the best methods of treatment for such a raw water supply as obtained under conditions at Chicago. It is estimated that the cost of such an experimental plant should not exceed $100,000, while that of one of the permanent plants with a capacity of 300,000,000 gals. daily would be from $7,000,000 to $8,000,000.

In his report Mr. Ericson makes five recommendations: (1) An ordinance for universal metering; (2) an appropriation of $100,000 for one or two experimental plants; (3) examination of the tunnels to discover any pollution through seepage, and to eliminate such pollution; (4) negotiations with the park boards for the reservation of sites; (5) study of designs for water filtration plants.

Contract Let for Guernsey Dam

Contract for constructing the Guernsey dam on the North Platte reclamation project has been awarded to the Utah Construction Company. Its bid was $1,288,121.

Injunction Denied Strauss Co. in Seattle Bridge Suit

The U. S. Circuit Court of Appeals (9th circuit) sitting in San Francisco, on April 20, handed down a decision denying the injunction asked for by the Strauss Bascule Bridge Co. to prevent the construction by the city of Seattle, Wash., of the Montlake bridge across Lake Washington Canal. The Strauss Co. had previously brought suit against Seattle in the U. S. district court alleging infringement of patents and asking for temporary injunction; the injunction was denied in that court and the Strauss Co. appealed from the order of denial to the U. S. circuit court of appeals.

In deciding against the Strauss Co. in the matter of the injunction the circuit court of appeals has the following to say with regard to the fundamental question of validity of the Strauss patents: "The fact that the patent has been sustained by the court of appeals for the sixth circuit (Strauss Bascule Bridge Co. vs. city of Chicago, 261 Fed. 358), is entitled to our respectful consideration. But it appears that in the present application for injunction the court had before it certain material evidence which was not before the court in the case cited." The new evidence submitted bearing on Strauss patent claims 9 and 10, which constitute the chief basis of the present litigation, is referred to elsewhere in this decision as follows: "The city, through affidavits of engineers and others, denied infringement to any extent and with detailed statement set forth that the structure being built by the city is mechanically substantially like the structure called for in Patent No. 738,954, for bridge granted to Strauss, Sept. 15, 1903, and filed Dec. 19, 1902, now expired. Affidavits in behalf of the city also set forth that what is called the precision scale balance constitutes complete anticipation of claims 9 and 10 of the patent in suit."

No date has been announced for trial of the case dealing with the question of validity of the patents.

Cincinnati Lets 5-Year Contract for Garbage Service

A contract for the collection and disposal of the garbage, dead animals and animal offal of Cincinnati, Ohio, for the five years beginning June 1, 1926, has been let to the Union Reduction Co., of Cincinnati for $1,012,500. The only other bidder was S. D. Clark of Pittsburgh, Pa. Collections from markets, hotels and restaurants, fish markets, butcher-shops, slaughter houses, hospitals and produce commission houses are to be made daily; and from the rest of the city from three times a week in summer and twice in winter to twice a week in summer and once in winter, according to the character of certain stipulated districts. Tonnages reported collected by contractors in earlier years increased from 41,720 in 1913 to 54,190 in 1916; fell to 32,472 in 1918; rose to 51,934 in 1922, fell to 45,404 in 1923, and rose to 57,068 in 1924.

Large Attendance and Much Work at A.W.W.A. Meeting

Standardization Council Has Part in Program—Beekman C. Little Made Secretary

What was generally held to be the largest and in many respects the best convention of the American Water Works Association was held at Louisville, Ky., April 27 to May 1. The registration was well above 1,200. Besides the general meetings, three technical divisions functioned: Chemical and Bacteriological, Fire Prevention, and Plant Operation and Management.

Early and late, the week through, the Standardization Council was at work either in committee or else in charge of the general convention, eliciting opinions and giving final shape to its forthcoming Manual of American Water-Works Practice. The driving force in this council work was the chairman, George W. Fuller who, to use the term in common parlance and employed by himself, constantly "dog-whipped" his many sub-committee teams. These committees will be greatly reduced in number from now on.

The leading technical papers, and committee reports are summarized beginning on p. 771 of this issue.

New Secretary Chosen

At the very close of the meeting it became known to a few that the incoming executive committee had chosen as secretary Beekman C. Little, a past-president of the society who for many years had been superintendent of water-works at Rochester, N. Y. The New York office of the association will be retained, with W. Niesley, who has served as secretary the past year, as assistant to the secretary to carry on executive details. Mr. Little will continue his superintendency at Rochester.

A memorial service to some twenty members deceased in 1924-25, including past-president and secretary emeritus John M. Diven, was the opening feature of the convention. The Diven Memorial Committee, through Alexander Milne, St. Catherines, Ont., recommended and the convention adopted a plan for a Diven bronze medal. This will be awarded annually to the active member who, in the opinion of a committee on award, has rendered the greatest service during the past year (1) by contributions to the *Journal* or meetings of the association and (2) for the advance of water-works. By preference the award is to go to a person connected with the operation of a water-work plant.

New Officers and 1926-7 Nominees

There having been no opposition to any of the candidates nominated a year ago the following will serve for 1925-26: President, Harry F. Huy, general manager, Western New York Water Co., Buffalo; vice-president, George W. Batchelder, water commissioner, Worcester, Mass.; treasurer (re-elected) W. W. Brush, deputy chief engineer, Department of Water Supply, New York City. Technical division chairmen were elected as follows: Plant Management and Operation, James E. Gibson, manager and engineer Water Department, Charleston, S. C.; Fire Protection, Nicholas S. Hill, Jr., consulting engineer, New York City (re-elected); Water Purification (formerly Chemical and Bacteriological), James W. Armstrong, superintendent filtration, Baltimore, Md. For 1926-27, the nominating committee chosen at the Louisville meeting, announced that Mr. Batchelder was proposed for president and E. E. Wall, water commissioner, St. Louis, Mo., for vice-president.

Five names were added to the list of honorary members: William P. Bull, Peoria, Ill.; J. P. Donahue, Colfax, Iowa; Dow R. Gwinn, Terre Haute, Ind.; J. Waldo Smith, New York City; Prof. W. P. Mason, Troy, N. Y. A budget of $35,000 was adopted. The membership on March 31, 1925, was 2,158 a net gain of 222 for the year. Among the numerous constitutional amendments was one governing affiliation with other societies; one providing that nominees for president and vice-president must have served at least two years on the executive or some standing committee; a provision for an administrative committee to act in lieu of and subject to the approval of the executive committee.

Water-Works Manufacturers' Association

An extensive exhibit of water-works appliances was provided by the associate members composing the Water Works Manufacturers' Association. The association gave a smoker and extended many other courtesies to the members, the ladies and other guests. An evening was set aside for papers by members of the association, as follows: Steel Tanks, by J. E. O'Leary, Pittsburgh-Des Moines Steel Co.; Pipe Coatings, by J. Linden Stewart, Wailes Dove—Hermiston Corp., New York City; Water Treatment by Chemicals, R. J. Quinn, Mathieson Alkali Works, New York City.

The Chemical and Bacteriological Division changed its name as already indicated. Besides committee work and round table discussions it considered the following group of papers on the Effect of Treated Waters on Industrial Wastes; Chlorinated Water in the Baking Industry, by C. B. Morrison, American Baking Institute, Chicago; Treated Waters in the Canning Industry, by A. E. Stevenson, Research Laboratories, National Canners' Association, Washington, D. C.; Chlorophenol Tastes in Milwaukee, by R. W. Cunliffe, city chemist.

Buffalo, N. Y., the home town of the new president, was chosen as the meeting place for the 1926 convention.

New Chief Engineer of the Reclamation Service

R. F. Walter became chief engineer of the Bureau of Reclamation on May 1. Since the resignation of F. E. Weymouth last fall, Mr. Walter has been acting chief engineer.

Goodrich Appointed Engineer for Albany Port Project

Ernest P. Goodrich, consulting engineer, New York, who has been acting as a consulting engineer on traffic for the Regional Plan of New York, has been engaged to prepare a comprehensive plan for the development of the port of Albany under the legislation enacted by the State Legislature this year. The plan is to be ready by Nov. 20.

Mr. Goodrich was for four years chief engineer for the Bush terminal at New York and was for a time director of the Bureau of Statistical Research of New York City. He has served a number of cities as a consulting engineer on city plan and terminal work and was a member of the board appointed to report on equipment for the New York State Barge Canal terminals.

Allen W. Keller will be assistant engineer to Mr. Goodrich at Albany.

Mississippi Spillway Permit Given

A permit allowing the removal of eleven miles of levee, to create a spillway on the lower Mississippi, was approved by the acting secretary of War, May 4. This action followed a favorable recommendation by the Chief of Engineers, the Mississippi River Commission and the District Engineer at New Orleans.

The levees are to be removed at a point sixty-three miles below New Orleans, near Point-a-la-Hache. This will allow the waters of the Missisippi, at flood stage, to flow into Breton Sound, an arm of the Gulf of Mexico.

Colonel George M. Hoffman, the division engineer, submitted a report opposing the granting of the permit on the ground that danger to federal improvements at the mouth of the Mississippi River is incurred. Colonel Townsend, the district engineer, held that South Pass would be benefitted were less water to flow through it, while at Southwest Pass the problem has been to maintain depth during low water rather than during floods, as the Pass scours at high stages and fills during low water.

Associated General Contractors Board to Meet

The Executive Board, the Advisory Board, and the Presidents' Council of the Associated General Contractors will meet at Washington, D. C., May 18-21, in their regular quarterly session.

One of the subjects for discussion will deal with excerpts of bills appearing before the legislatures of the different states and dealing with the construction industry. It appears that the amount of this sort of legislation is increasing. Realizing that no single state has had to concern itself with all the variations of this legislation, and that the experiences of one state may be of major importance to another when confronted with similar problems, the A.G.C. is preparing itself to render a new type of service by collecting and analyzing the nation-wide legislative activities affecting constructors.

WASHINGTON NOTES

The International Streams Commission, of which Dr. Elwood Mead is chairman of the American Section, is to be enlarged. Two new members of the Commission probably will be named.

In addition to Dr. Mead the present members of the Commission are General Lansing H. Beach, formerly chief of engineers, and W. E. Anderson of Texas.

The commission's study is to cover both the Rio Grande and Colorado Rivers. Mexico has asked that ten months be allowed for the members of its section of the commission to familiarize themselves with the situation and with the work done by the Diaz Commission prior to 1910.

The Rio Grande Commission of which Secretary Hoover is chairman, is to deal with the river above El Paso. The problem is to determine the respective shares of water to which Texas, New Mexico and Colorado are entitled. Texas only recently was in a position to name its member of the commission. This now has been done, however, but hearings will not be held until fall.

Evidence is present on every hand on the reclamation projects that the new policy of no blanket relief is having a very salutary effect, Dr. Elwood Mead, the Commissioner of Reclamation, found on his recent western trip.

The results of the policy of individual relief, only, already are showing in the payments that are being made. Dr. Mead had frequent opportunity on this trip to bring home to the land holders that the department is in earnest in its insistence that obligations be met.

It is significant, Dr. Mead feels, that the first three projects, which he and Secretary Work visited on this trip, had come within 3 per cent of meeting their payments. These projects are Carlsbad, Rio Grande and Yuma.

Dr. Mead believes that, in the future, more pride will be taken in the meeting of payments. In some instances in the past, he thinks delinquencies would have been avoided if the energy devoted to the devising of means of escape from obligations had been applied to constructive efforts to comply with promises. The fact that the department is going ahead with its suits also is having its influence on the increased number of payments.

The protests against these policies are coming from absentee owners and speculators, Dr. Mead thinks.

Increased activities in connection with the St. Lawrence project have led the Great Lakes-St. Lawrence Tidewater Association to transfer all of its executive activities to Washington. Charles P. Craig, who has been directing the affairs of the Association from Duluth, now will transfer those activities to Washington from which point intensive work is to be undertaken, with the intention of keeping the project in the public eye.

Joint Fire Prevention Committee Formed to Reduce Fire Loss

The American Water Works Association, through its outgoing president, Frank C. Jordan, recently consummated the plan originated at the annual convention in New York last May of creating a joint committee composed of five members each of the American Water Works Association, The International Association of Fire Engineers and the National Fire Protection Association with the object of working together and with all other interested organizations to reduce the fire waste of the nation which last year aggregated more than $500,000,000. The committees' program contemplates, beside the establishment of closer relations between city fire and water departments, a study in each large American city of the local fire hazards, the building code, the fire prevention ordinances and the fire-fighting facilities, and the furtherance of all effective forms of fire prevention by creating about the fire chief a body of influential citizens who shall act as his cabinet and assist him in his plans for making his city fire safe. The officers of the Joint committee are: Frank C. Jordan, chairman, Indianapolis, Ind.; vice-chairman, J. W. Stevens, chief inspector National Board of Fire Underwriters, San Francisco, Calif.; secretary, Franklin H. Wentworth, secretary National Fire Protection Association, Boston, Mass.

Barge Canal Water Used Without Adequate Return to State

Four specific instances in which surplus waters of the New York State Barge Canal are being used for power purposes without adequate return to the state have been reported to the State Water Power Commission by the superintendent of public works. They are as follows: Medina, Orleans County, double use of the water by S. A. Cook & Co. and the Western New York Utilities Co.; at Fulton, Oswego County, by the Fulton Light, Heat & Power Co., under a temporary war permit; at Rochester, by the Rochester Gas & Electric Co.; and at Northumberland, Saratoga County, by the Iroquois Pulp & Paper Co. under a revocable permit.

Two Engineers on Commission on Baltimore Zoning Problem

The zoning problem in Baltimore, Md., created by the recent adverse court decision on the zoning ordinance of that city, is to be studied by a local commission appointed by the mayor. Among the members of the commission are Gustav J. Requardt, vice-president of the Engineers Club, and V. Bernard Siems, water engineer and president of the water board.

Florida East Coast Authorized to Build 29-Mile Extension

The Interstate Commerce Commission has authorized the Florida East Coast Railway Co. to construct an extension of its line from St. Augustine to Bunnell, Fla., a distance of 29 miles.

Delaware River Compact Waits Further Action by States

At the close of the legislative season it is of interest to note the status of the Delaware River Compact which was reported in our issue of February 5, 1925, as having been agreed upon by commissioners designated by the states of Pennsylvania, New Jersey and New York.

In New Jersey the legislature referred to a select board of seven consideration of the water situation in all parts of the state, including a study of the proposed compact. This board is to report its recommendations to the legislature of 1926.

In Pennsylvania the compact, as recommended by the Treaty Commission after having passed the Senate, was amended in the Assembly to include certain reservations which had been proposed by New Jersey. It then passed the Assembly but failed of passage in the Senate because by that time it became evident that no action would be taken by the New Jersey legislature.

In New York the compact, with the reservations and amendments proposed by New Jersey, was passed without opposition and the law adopting it was signed by Governor Smith on March 18.

The reservations suggested by New Jersey and agreed to by the commissioners of the other states were to the following effect: (a) That each State might appoint or designate its representatives on the Tri-State Commission in such manner as its legislature might determine; (b) that nothing contained in the compact should be construed as enlarging any vested right, or as creating any new vested right, or as reviving any claim of right which may have lapsed by forfeiture or by non-use; (c) that nothing contained in the compact should be construed as in any manner limiting the exercise of the right of condemnation not in conflict with the order of preference set forth in the compact as such right now exists or may hereafter be granted in any state, and (d) eliminating the exception made in the case of existing intakes by requiring approval of the Tri-State Delaware River Commission for every project involving the removal or diversion of more than two million gallons of water per day from the channel of the Delaware River.

As the Pennsylvania legislature does not meet again until 1927, it appears that final action is deferred until at least that year, although the matter may again be before the legislatures of the other states next year.

To Dig 24-ft. Narrows Tunnel

The Board of Estimate of New York City, on May 5 voted to build a 24-ft. diam. tunnel under the Narrows between Brooklyn and Staten Island instead of an 18-ft. diam. tunnel which it was anticipated would be built following the passage of the Nicoll-Hofstadter bill eliminating the freight route features from the proposed Narrows tunnel and making it purely a rapid transit tunnel requiring a smaller size bore.

Engineering Societies

Calendar

Annual Meetings

NATIONAL FIRE PROTECTION ASSOCIATION, Boston, Mass.; Annual Convention, Chicago, May 12-14, 1925.

AMERICAN ASSOCIATION OF ENGINEERS, Chicago, Ill.; Annual Convention, Orlando, Fla., June 2-5, 1925.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, University of Pittsburgh; Annual Meeting, Union College, Schenectady, N. Y., June 17-20, 1925.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Pa.; Annual Meeting, Atlantic City, N. J., June 22-26, 1925.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Summer Meeting, Salt Lake City, July 8-10, 1925.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburg, Fla.; Annual Meeting, Des Moines, Iowa, Oct. 26-29, 1925.

The National Fire Protection Association will hold its annual convention at the Congress Hotel, Chicago, May 12, 13 and 14. The afternoon of Wednesday, May 13, will be devoted to an inspection of Underwriters Laboratories.

The Taylor Society, an international society to promote the science and art of administration and of management, will hold its 1925 meeting at Ann Arbor, Mich., May 14, 15, and 16, under the auspices of the University of Michigan.

The Oregon Section, American Society of Mechanical Engineers, will meet in Portland, Ore., June 22-25, inclusive. Among the papers to be presented will be one on "Latest Developments in High-Head Hydraulic Turbines With Special Reference to the Oak Grove Plant of the Portland Electric Power Co.," by Ely C. Hutchison, of the Pelton Wheel Co., San Franciso, and one on "Hydraulic Dredges as Exemplified by the Clackamas, Latest Type Diesel Electric 30-In. Suction Dredge of the Port of Portland Commission," by James H. Polhemus.

Personal Notes

DR. SAMUEL FORTIER, associate chief of the Division of Agricultural Engineering, Bureau of Public Roads, U. S. Department of Agriculture, retired from active service on April 24. He will, however, continue his connection with the bureau in carrying to conclusion the lines of research work to which he has devoted considerable time in recent years. In 1907 Dr. Fortier succeeded Dr. Elwood Mead as chief of irrigation investigations, which position he has since held continuously, his title having been changed to associate chief, Division of Agricultural Engineering, some three or four years ago. During the 18 years Dr. Fortier has directed the work of the Irrigation Division a large amount of experimental work has been carried on with a view to the improvement of irrigation practice and the better design and operation of irrigation systems. WALTER W. MCLAUGHLIN succeeds Dr. Fortier with the title of acting associate chief.

DR. ELWOOD MEAD, Commissioner of Reclamation, has been awarded the honorary degree of Doctor of Laws by the University of Michigan; the degree will be conferred June 15. Dr. Mead also has been made a member of the National Research Council and has been assigned to the division of Federal Relations.

C. E. GRUNSKY of San Francisco and WILLIAM MULHOLLAND of Los Angeles have been retained as consulting engineers by directors of the Sacramento (Calif.) Utility District, to review the report of City Manager Albert Givan on the Silver Creek project, Sacramento's proposed municipal water and power scheme.

R. C. BURLESON, assistant to the chief engineer to the supervisor of public utilities, Dallas, Texas, has been appointed chief engineer to succeed Major Powell.

A. MCPHAIL, Galt, Ont., has been appointed assistant city engineer of Galt, succeeding WILLIAM REIHL who has been appointed city engineer at Brampton, Ont.

RUDOLPH P. MILLER, consulting engineer, announces the opening of offices at 342 Madison Ave., New York City, where he will serve his clients in matters of building construction and materials, fire protection and safety, legal requirements, appeals, zoning and arbitration.

JOHN C. TRAUTWINE, 3D., following the death of his father last July, has moved the executive and editorial offices of the Trautwine Co. to 331-5 W. Front St., Media, Pa., where he will continue the revision and publication of the Civil Engineer's Pocket-Book. He will be open to professional engagements as well.

JAMES R. POLLOCK, sanitary engineer of the city of Flint, Mich., has been appointed city engineer of Pontiac, Mich.

H. A. ROWLAND has resigned as county engineer of McPherson County, Kansas, a position which he has held for twenty-eight years.

Obituary

ASA MATTICE, formerly chief engineer of the Allis-Chalmers Co., the Westinghouse Electric & Manufacturing Co., and the Westinghouse Machine Co., died April 19, at New York, in his 72nd year. Mr. Mattice was a graduate of the U. S. Naval Academy in the class of 1874, was principal assistant to Admiral Melville in the design of machinery for the Navy from 1886 to 1887, and for ten years was consulting engineer for the Calumet and Hecla Co. He retired from active life before the World War but returned to service during the War in an advisory capacity to the Remington Arms. Co.

WILLIAM ROSS GLASGOW died at St. Louis, Mo., April 19, in his 46th year. Mr. Glasgow was head of the Glasgow Engineering Co., of St. Louis, which company he formed after his graduation from Princeton University. During the War Mr. Glasgow served with the 128th Artillery, being discharged with the rank of captain.

REGINALD E. W. HAGARTY, consulting engineer, Toronto, Ont., died April 29 at Gravenhurst, Ont., after an illness of over a year. After graduating in 1908 from the University of Toronto, Mr. Hagarty was for some years connected with the Trussed Steel Concrete Co. Then he established himself as a consulting engineer, in Toronto, and specialized in structural steel and concrete work and carried out some important undertakings in this line.

ANDREW FEASTER WOOLLEY, who served as division engineer, U. S. Shipping Board, in charge of the shipyards at Seattle during the War, died in San Francisco, April 21. Mr. Woolley was born at Auburn, Ala., 1868, and graduated from A. & M. College and Polytechnic Institute, Auburn, in 1886. From the time of his graduation until 1890 he was on railroad construction and surveys in the South. From 1890 until 1901 he was on river and levee work along the lower Mississippi. In 1901 he went to Mexico on dock construction, remaining in Mexico as engineer for various companies on power plant construction, railways, river work and water-works.

GEORGE W. BROWN, civil engineer, a graduate of the University of Wisconsin and for past 35 years a civil employee in the Navy Department, died recently at San Diego, Calif., from injuries sustained when he was struck by a falling beam at the naval coaling station.

WILLIAM L. REYNOLDS, hydraulic and railroad engineer for the Colorado Public Utilities Commission, died April 16 after an operation for appendicitis. Born in Ohio, he came to Colorado in 1897 and after graduating from the University of Colorado as a civil engineer, he did much work in the field and during the War supervised the construction of the munition plant at Nitro, W. Va.

MASON H. BAKER, formerly city engineer at St. Thomas, Ont., died April 16 in a Toronto hospital, after a month's illness with spinal meningitis; he was 40 years of age.

JOHN W. WOOD, civil engineer, Malden, Mass., at one time superintendent of public works for Melrose, Mass., and for the past ten years with the Metropolitan District Commission of Massachusetts, died at his home in Malden April 16. Mr. Wood was chairman of the city planning board of Malden. He was a graduate of Georgetown University, Washington, D. C.

From the Manufacturer's Point of View

A Point of Contact
Between Maker and User of
Construction Equipment and Materials

Manufacturers Exhibit at Waterworks Convention

Seventy-Two Exhibits of Material and Equipment at Louisville Meeting

Engineering News-Record Staff Report

THE annual exhibit of the Water Works Manufacturers Association, held in Louisville, Ky., April 27-May 1, in conjunction with the annual convention of the American Water Works Association, gave a comprehensive review of the latest developments in materials and equipment available for every branch of the waterworks field. The exhibit was held in the Hawaiian Gardens, across the street from the Brown Hotel where the convention meetings took place. J. E. O'Leary, of the Pittsburgh-Des Moines Steel Co. was chairman of the committee in charge of the exhibits. The exhibits ranged in scope from sensitive chlorinating apparatus and meters to pipe and pipe jointing materials, and may be divided for purposes of classification into eight classes including seventeen exhibits of meters and meter boxes, fourteen exhibits of pipe, twelve exhibits of valves, fittings and hydrants, six exhibits of pumps, turbines, and wells, four exhibits of chlorinating equipment and chemicals, four exhibits of repair equipment, three exhibits of filters, and a miscellaneous group of six exhibits. The remaining part of the total number of exhibits was made up of engineering publications in the water works field.

Meters and Meter Boxes—The exhibit of meters and meter boxes was the most comprehensive in point of view of numbers of manufacturers present. The meters shown were for use in both open and closed channels and included disk and turbine type meters, pitot tubes, manometers, venturi meters and rate controllers. One company had an exhibit of meters ranging in size from ½- to 20-in. Several of the companies featured meter boxes, in addition to their other products. Following is a list of the manufacturers showing meters, meter boxes and accessories: Buffalo, Simplex Valve & Meter, Ford Meter Box, Gamon, Worthington Pump & Machinery, Builders Iron Foundry, Bingham & Taylor, National, Neptune, Hersey, H. W. Clark, Thomson, Federal, Van Gilder, Union, Badger, and Pittsburgh.

Pipe—The field of pipe was, as usual, well represented. In addition to cast-iron pipe, there were displays of lead-lined cast-iron pipe, cement-lined pipe and concrete pipe. A display of steel pipes ranging in size from ¼ to 96 in. was a feature. Hammer weld steel pipe was shown in diameters from 20 to 96 in. B. Nicoll & Co. featured Pont-a-Mousson French cast-iron pipe. Jointing materials were shown by the Leadite Co. and the Lead-Hydro-Tite Co. Other exhibitors displaying pipe were: R. D. Wood, National Tube, McWane, B. Nicoll, Central Foundry, Lead Lined Iron Pipe, U. S. Cast Iron Pipe & Foundry, Lock Joint Pipe, American Cast Iron Pipe, East Jersey Pipe, Cement Lined Pipe, National Cast Iron Pipe.

Valves, Fittings and Hydrants—Indicators, fire hydrants, pipe-tapping machines, pressure air valves, vacuum air valves, gate valves, globe valves, and brass fittings were some of the products shown in this group. The Mueller company gave a demonstration of copper service pipe and fittings under pressure. An automatic shut-off for gate valves, operated by the velocity of the water flowing through the pipe was shown by the Chicago Valve & Hydrant Co., as was also a hydrant which permits the removal of the valve and seat while under pressure.

The exhibitors showing valves, fittings, and hydrants included: Rensselaer, Ludlow, Mueller, Vogt Bros., Chicago Valve & Hydrant, Kennedy, Eddy, Glauber, Hays, Multiplex, Birch and Columbian Iron Works.

Pumps, Turbines and Wells—For both deep well and drainage pumping, a wide range of equipment was shown, including steam, air-lift and electric. In addition to the pumps, deep well screens and automatic tank control devices were exhibited; also a line of construction and maintenance diaphragm pumps, both hand and power-operated. Exhibitors of pumping equipment included Sullivan Machinery, Edward E. Johnson, De Laval Steam Turbine, Edson Manufacturing, A. D. Cook, and Layne & Bowler.

Chlorinating Equipment and Chemicals—A chlorinating boat, for use on open pools and large reservoirs, was a feature of the Wallace & Tiernan exhibit. In addition, this company showed a complete line of dry-feed equipment and chlorinating apparatus. Paradon Engineering Co. exhibited a new thermo-control chlorinator for small water supplies, swimming pools and sewage plants. Companies exhibiting chemicals were Electro Bleaching Gas and E. I. DuPont de Nemours.

Repair Equipment—Numerous devices for the repair and maintenance of water supply systems and equipment were shown. These included spring clamps for leak and service purposes, pipe pushers, tapping machines, sleeves, gate box locators and aquaphone leak locators. Manufacturers of repair equipment included Philbrook Spring Clamp, Waterworks Equipment, A. P. Smith and Giant Manufacturing.

Filters—A line of filter operating tables was shown by Roberts Filter Manufacturing Co. F. B. Leopold exhibited filtration equipment. The International Filter Co., in addition to dry chemical feeders, exhibited the Wagner block underdrain for filters.

Miscellaneous—Exhibits not previously classified included steel tanks and standpipes by Pittsburgh-Des Moines; surveying and current velocity measuring instruments, including a new graphic recorder for water levels in water supply and sewage practice by W. & L. E. Gurley; test and inspection methods for public utility equipment by Pittsburgh Testing Laboratories; methods of cleaning water mains by National Water Main Cleaning Company; Cole pitometer for waste water surveys by the Pitometer Co.; and a Bitumastic solution and enamel and Hermastic pipe coating for anti-corrosion work.

Retain Present Standard Thicknesses of Lumber

At the general conference of the lumber industry held May 1, at the Department of Commerce, Washington, D. C., a joint committee, composed of five manufacturers and five retailers, together with Secretary Hoover and Col. W. B. Greeley, Forester of U. S., as negotiators, reported in favor of continuing the present standard board at 25/32 in., finished, dry, and the extra-standard board at 26/32 in., during the next twelve months. In the meantime, the Forest Products Laboratory of the U. S. Forest Service, at Madison, Wis., is to study and review the whole subject, and report to the next general conference a final determination of the matter. The Laboratory was advised that it was desirable, if possible, to adopt a single instead of a double standard. The joint committee, as appointed by the respective groups, was as follows:

Retailers: E. Bruce Hill, chairman, Pittsburgh; J. F. Goodman, Kansas City, Mo.; F. S. Lowrie, Detroit; Harry E. Smock, Asbury Park, N. J.; W. Thornton Estes, Birmingham, Ala.

Manufacturers: Charles Hill, New York; Ernest Dolge, Tacoma; A. W. Cooper, Portland; R. E. Donaher, Detroit; C. C. Sheppard, New Orleans.

Only Inch Boards Extra-Standard

Efforts to extend the application of extra-standard thicknesses to other dimensions and to other items of lumber than boards were unsuccessful. The revisions and additions to the American Lumber Standards, recommended by the Central Committee on Lumber Standards as of March 13-14, were accepted with some minor alterations. No changes were made in lumber classifications. The standard names of commercial softwoods were accepted as reported. The recommendations as to defects and blemishes were adopted without change. Standard dressed thicknesses were established with the extra-standard for inch boards only.

The study of the distribution and consumption of odd and short lengths is to be continued and brought before the next general conference which will be held in Washington, about May 1, 1926.

Conference Board Reports on Trade Associations

The National Industrial Conference Board, 247 Park Ave., New York, as a part of a series of investigations dealing with various economic and legal problems, has just issued a report under the title of "Trade Associations, Their Economic Activity and Legal Status." It is divided into five main parts. Part 1 deals with trade associations and the anti-trust laws, Part 2 with the evolution of public policy toward competition and co-operation, Part 3 with association activities and the regulation of competitive conditions, Part 4 with association activities essentially unrelated to competitive conditions, and Part 5 with the place of trade associations in the industrial structure.

Legal Aspect—The legal status of trade associations has always been a debatable question. The Conference Board, in its report says: "The legal principles governing trade associations are not essentially distinguishable from those applying to other forms of business organization. The lawfulness of a trade association depends in every instance upon the concrete purposes for which the association members are bonded together, and upon the means employed to advance these purposes. Purposes and intentions are judged in the courts primarily by actions, however, so that it is what an association does and how it does it which finally determines its legal status."

Trade association activities fall into two classes when considered from the legal point of view: those that are covered by existing laws and those that go outside of the law, as it were, and attempt to formulate practices not yet specifically sanctioned by law. In the first class are the activities that center around common production and price policies which are generally held to act as a suppression of competition and are hence unlawful. When associations go outside of the settled law, their activities are either condemned or sanctioned according to the ruling of the court. These activities are concerned to a large extent with ethical standards. Trade associations have also fostered uniform contract forms, attempted to reduce cancellation of contracts, formulated plans to iron out seasonal peaks of production, and undertaken other similar work. The board lists the following activities "as being representative if not exhaustive of this category of trade association function: (1) Operation of exchange, (2) collection and dissemination of trade statistics, (3) interchange of patent rights, (4) interchange of credit information, (5) negotiation of purchases, (6) standardization of products, (7) development of business standards. These activities, it is apparent, aim for the most part to utilize the trade association as a clearing house of knowledge, information, and experience for the common benefit of the industry as a whole."

The collection and dissemination of trade statistics is an activity of trade associations that has often been questioned as to its legality. The Conference Board states in this connection that "the collection and dissemination of trade information in some measure and through some channel appears to be indispensable to the smooth ordering of manufacturing and marketing activity."

Economic Aspect—The present tendency of business toward organization and co-operation has been brought about by such economic changes as the increased need for conservation of waste, the growing dangers of overproduction brought on by too zealous competition, and the necessity of developing foreign markets to dispose of surplus production. The position that the trade association holds in the industrial structure is defined. The report states that "the advantage to the public of protection against exploitation which is offered by the competitive system may be destroyed by the energy with which the self-interest of independent competitors is pursued." The trade association should act as a check on this tendency of individuals to carry competition beyond economically sound lines which "in the long run can only lead to industrial ruin."

The subject of commercial arbitration is discussed in the report with the conclusion that the arbitration process must be wholly of a voluntary nature.

Mixer Standardization

Committees of the American Association of State Highway Officials have been invited to attend a meeting scheduled for May 6, at the La Salle Hotel, Chicago, to take up further details relating to the standardization of the paving mixer now commonly designated as the 21-E.

The meeting has been called by the Mixer Manufacturers Bureau, affiliated with the Associated General Contractors of America. In addition to the state highway officials, representatives of the following interests have been invited: highway constructors; manufacturers of mixers; manufacturers of batch boxes; manufacturers of industrial railroad equipment; manufacturers of batcher plants; and manufacturers of trucks.

Outdoor Good Roads Show for New England

Plans are being made for first annual outdoor good roads show to be held in Cambridge, Mass., on May 14, for one day only, under the auspices of the Massachusetts Highway Association with whom are co-operating the highway officials of the other New England states.

Such machinery as tractors, graders, concrete mixers and pavers will be shown in operation.

Edwin A. Rogers, President of Massachusetts Highway Association, is working on the show plan with the following executive committee: Frederick W. Mattheis, of Hedge & Mattheis; C. F. Reuter, Mead-Morrison; George E. Pearson, Acme Road Machinery Co.; Walter Railsbach, New England Road Machinery Co.; Pearley A. Dyar, Dyar Sales & Machinery Co.

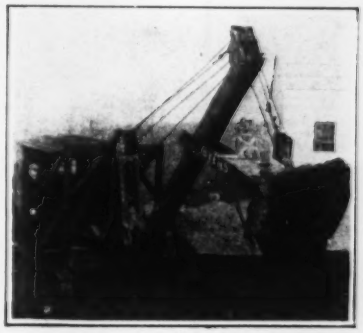
Equipment and Materials

New "Bear Cat" Attachment Is ½-Yd. Shovel

The Byers Machine Co., of Ravenna, Ohio, has added to its line of attachments for the Byers "Bear Cat" a ½-yd. shovel.

The ½-yd. shovel developed within the last year, is the eighth attachment for this machine. Distinction in its design lies in the fact that the crowding device is quite different from that usually found in gasoline shovels. The boom and dipper are both operated through live drums, the boom being raised and lowered to effect the crowd and to shake the dipper. The dipper stick is hinged to the boom directly and the design so carried out that the operator has absolute control over the boom providing the maximum crowding effort in either direction. At the same time it eliminates all the shipper-shaft mechanism, crowd drums etc., which are usually found in this equipment, thereby avoiding considerable wear at this point and reducing the cost of this mechanism.

The shovel has the same dumping clearance as ¾-yd. machines. The dipper may be shaken to dump sticky material very efficiently. A daily average of 300 to 400 cu.yd. may be expected and the manufacturers claim for the entire machine a very low first cost and low cost of operation.



Centrifugal Pump Motor of 2,700-Hp. Capacity Made

A 2,700-hp. motor, to be used for the driving of a centrifugal pump in the new electric dredge Clackamas for the Port of Portland was shipped from the East Pittsburgh plant of the Westinghouse Electric & Manufacturing Co. to Portland, Oregon, recently. The motor is the largest of its kind ever built for use in a centrifugal pump and was made on a special order from the Port of Portland Commission.

The dredge for which the motor was prepared is the largest suction dredge ever constructed and will be the first large-sized dredge to use the diesel electric engine.

The motor weighs 40 tons. Its frame is 11½ ft. in diameter and the shaft 12 ft. in length.

Engineering News-Record Statistics of the Construction Industry

May 7, 1925 — in the United States — Vol. 94, No. 19

Engineering News-Record CONSTRUCTION COST Index Number (1913 = 100)

MONTHLY

Jan. 1924 to Date

May, 1925	207.20
April, 1925	209.55
May, 1924	222.33
Peak, June, 1920	273.80
1913	100.00

1924

Jan.	217.90	May	222.33	Sept.	211.25
Feb.	220.30	June	216.85	Oct.	207.55
March	224.60	July	214.40	Nov.	205.70
April	221.60	August	213.15	Dec.	208.58

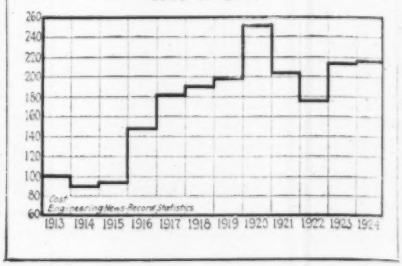
1925

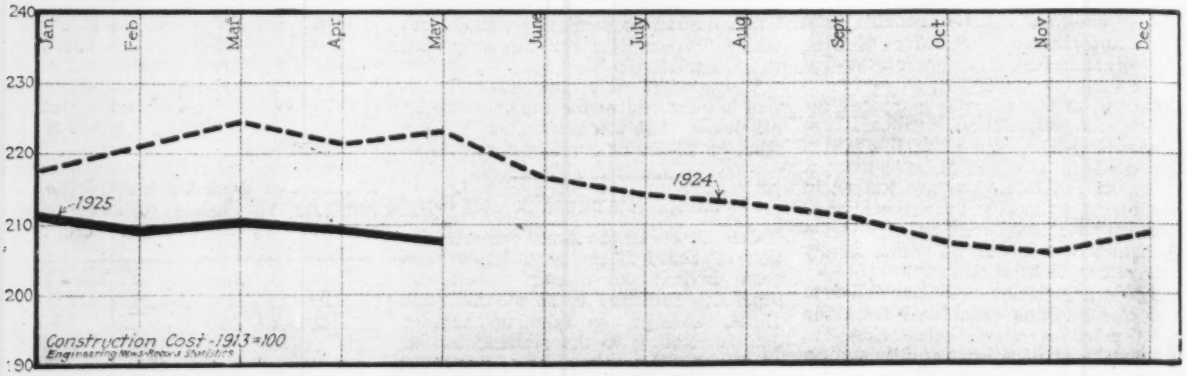
Jan.	210.40	Feb.	209.70	March	210.20

ENGINEERING NEWS-RECORD'S Construction Cost Index Number declined 2.35 points since last month owing to slightly lower cost of steel, lumber and common labor. The average rate for common laborers is now 54c. per hr. for the entire country, against 54½c. one month ago and 56c. in May, 1924. Thus general construction cost is 7 per cent lower than one year ago and 24 per cent under the peak; it is 107 per cent above the 1913 level.

YEARLY

1913 to 1924





Engineering News-Record CONSTRUCTION VOLUME Index Number (1913 = 100)

MONTHLY

Jan. 1924 to April, 1925

April, 1925	211
March, 1925	161
April, 1924	159
Peak, May, 1922	221
1913	100

1924

January	125	May	194	September	159
February	144	June	149	October	164
March	151	July	161	November	128
April	159	August	162	December	145

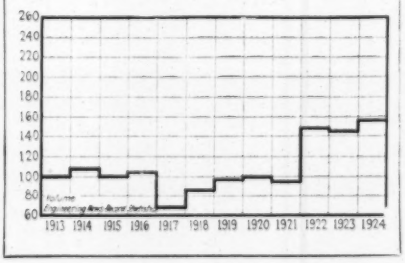
1925

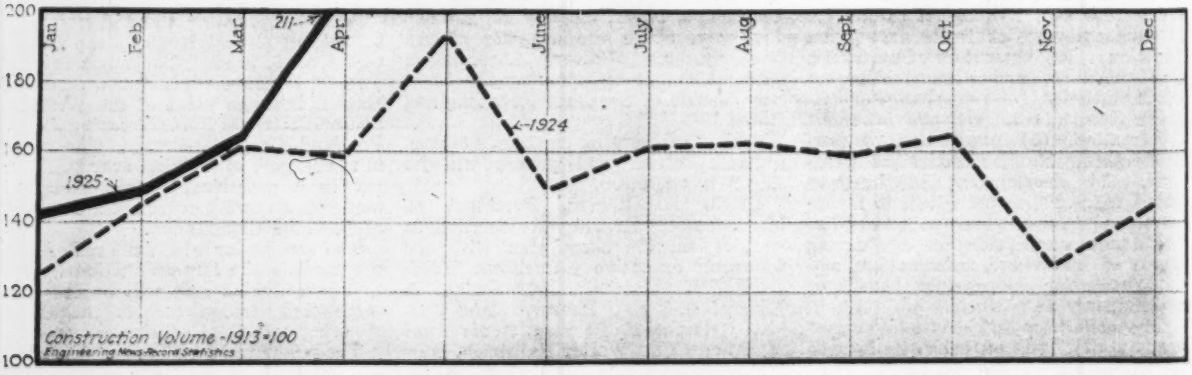
January	141	February	145

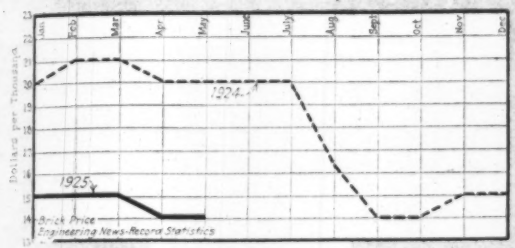
ENGINEERING NEWS-RECORD'S Construction Volume Index Number is 211 for the month of April, and 154 for the whole of 1924, as against 100 for 1913. This means that the actual volume of construction in 1924 (not the mere money-value of the contracts let that year) is 54 per cent above the volume of construction for 1913. The monthly volume number, 211 for April, 1925, contains the increment of construction and indicates the rate at which contracts are being let as compared with 1913 awards.

YEARLY

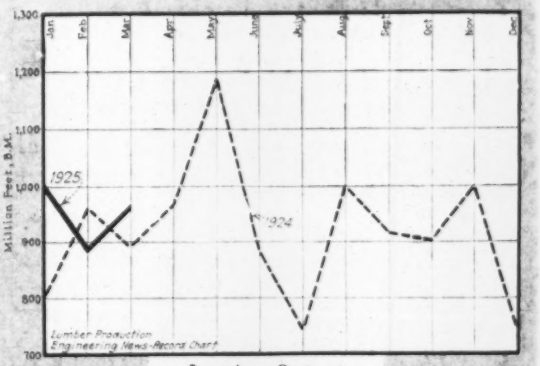
1913 to 1924



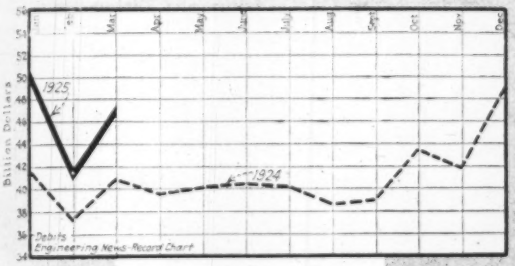




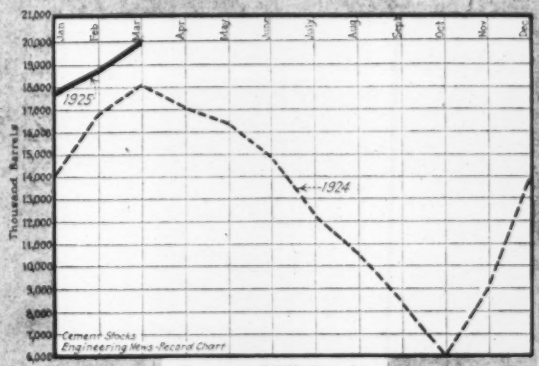
Price of Brick
At Dock, New York



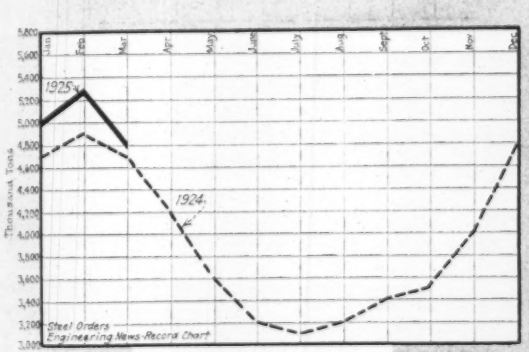
Lumber Output
Nat. Lumber Mfrs. Assn.



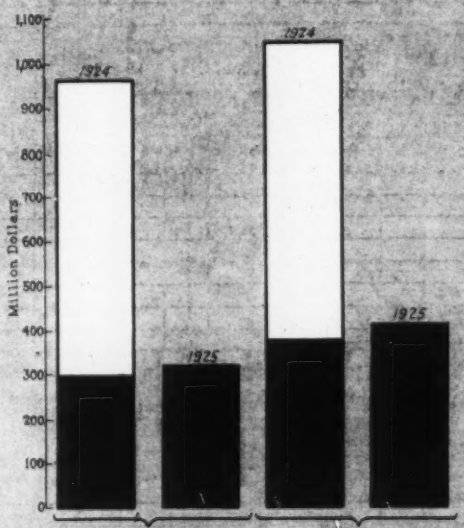
General Business Trend
Bank Debits—Federal Reserve



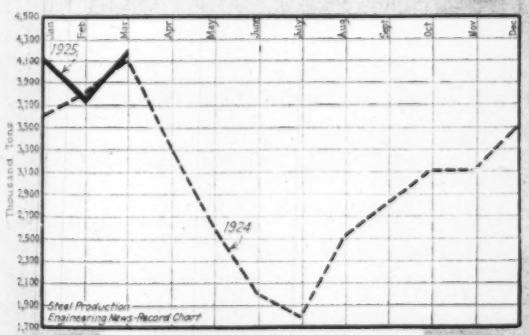
Cement Mill Stocks
Geological Survey



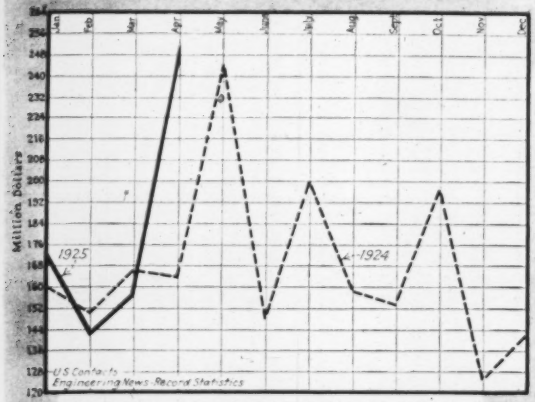
Unfilled Tonnage
On Books of U. S. Steel Corp.



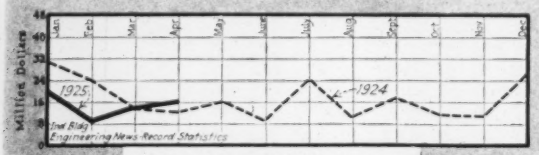
Public—Contracts—Private
Jan. 1 to date
Reported by E. N.-R.



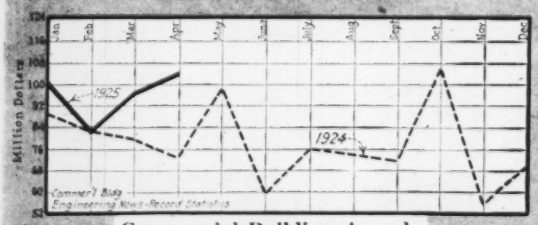
Steel Ingot Output
Gross Tons; Am. Iron and Steel Inst.



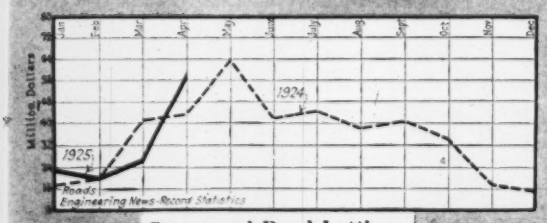
Contracts Awarded in the United States
Reported in E. N.-R.



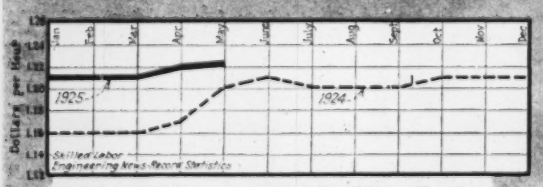
Industrial Building Awards
$40,000 and Over



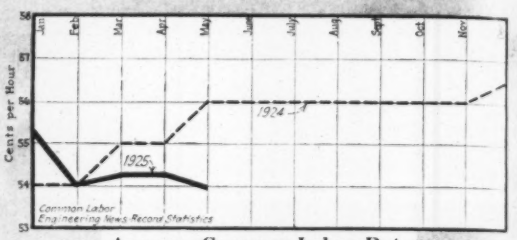
Commercial Building Awards
$150,000 and Over



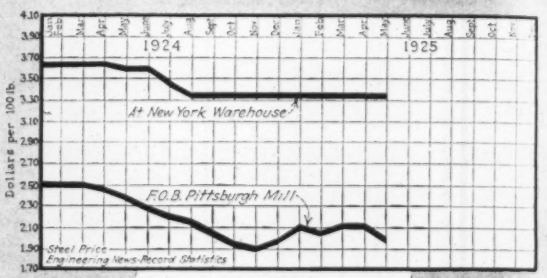
Street and Road Lettings
$25,000 and Over



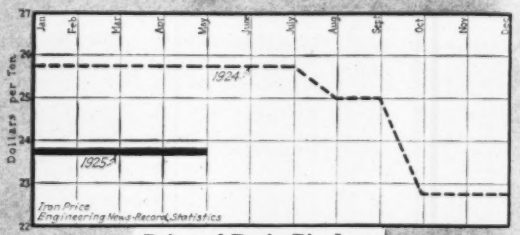
Average Wage of Skilled Building Trades
Bricklayers, Carpenters and Steel Erectors



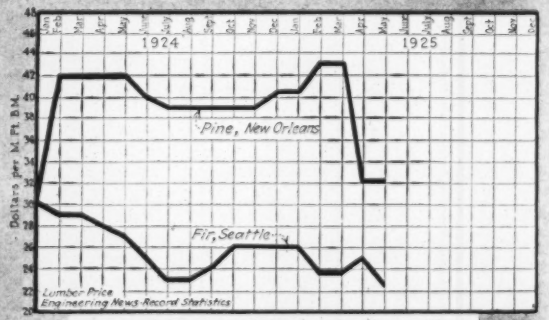
Average Common Labor Rate
Pick and Shovel Men



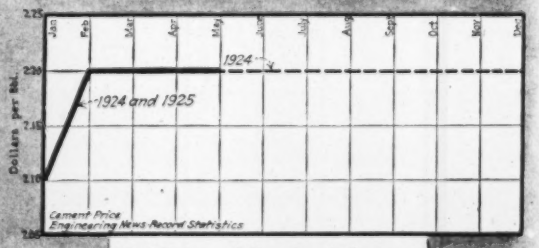
Price of Steel Structurals
Shapes 3-In.; Plates ¼-In.



Price of Basic Pig Iron
F.o.b. Pittsburgh



Price of Timbers, Wholesale, Base Sizes
Car Lots to Contractors



Net Price of Portland Cement
Car Lots, F.o.b. Chicago

Contract Value for First Four Months Ten Per Cent Ahead of Same Period Last Year

THE actual physical volume of April construction was the heaviest recorded, for any single month, since May, 1922. This represents quantities of materials used on a 1913 price basis, as shown by the *Engineering News-Record's* Construction Volume Index Number on the preceding page.

Measuring construction by money value of contracts let, it is found that this year (Jan. 1 to May 1) is 10 per cent ahead of the same period in 1924, as shown by the table below.

Value of proposed work is only 2 per cent ahead of the same period last year. This might show that during the last half of the current year, construction will come down nearer to the 1924 level. Last year established a record for all time. In money value of projected construction for the first four months of this year, the following classes showed an average gain of 44 per cent over the corresponding period last year: water-works, sewers, commercial buildings, Federal Government work, and unclassified jobs.

Minimum costs observed in this tabulation are: water-works and excavations, $15,000; other public works, $25,000; industrial buildings, $40,000 and commercial buildings, $150,000.

At the minimum costs mentioned, there were 5,394 proposed jobs reported during the period, Jan. 1 to May 1, 1925. A total of 2,397 projects on which bids were desired, 614 on which bids were received and 2,775 contracts awarded, which, with the proposed work, amounted to 11,180 items, were published in the Construction News section of *Engineering News-Record* during the past four months.

In these reports, so far as the actual number of projects was concerned, commercial buildings held the lead with streets and roads second and industrial buildings third.

Value of Contracts Let in the United States and Canada, April, 1925

	New England	Middle Atlantic	Southern	Middle West	West of Mississippi	Far West	United States	Canada	Grand Total
Water-works	$304,000	$574,000		$1,216,000	$7,501,000	$688,000	$10,283,000	$153,000	$10,436,000
Sewers	173,000	940,000	$340,000	1,734,000	567,000	2,210,000	5,964,000	180,000	6,144,000
Bridges	311,000	1,632,000	1,564,000	977,000	2,033,000	237,000	6,754,000	115,000	6,869,000
Excavation, dredging, etc.		84,000	47,000	22,000	137,000	15,000	308,000		308,000
Streets and roads	1,465,000	23,828,000	8,390,000	14,166,000	7,850,000	4,343,000	60,042,000	759,000	60,801,000
Industrial building	2,114,000	1,410,000	202,000	3,645,000	4,764,000	5,548,000	17,683,000	3,800,000	21,483,000
Commerical building	14,157,000	29,441,000	1,898,000	36,693,000	13,062,000	11,392,000	106,646,000	3,462,000	110,108,000
Federal Government	85,000	728,000	2,087,000	858,000	1,438,000	357,000	5,553,000		5,553,000
Unclassified	171,000	26,990,000	323,000	5,415,000	983,000	6,388,000	40,270,000	2,465,000	42,735,000
April, 1925	$18,780,000	$85,627,000	$14,851,000	$64,729,000	$38,335,000	$31,181,000	$253,503,000	$10,934,000	$264,437,000
April, 1924	5,769,000	46,203,000	20,614,000	40,501,000	24,504,000	25,978,000	163,569,000	11,346,000	174,915,000
March, 1925	19,160,000	45,859,000	13,381,000	25,678,000	34,155,000	18,678,000	156,911,000	2,559,000	159,470,000
1925, Jan. 1 to May 1	62,587,000	235,282,000	59,700,000	136,000,000	131,049,000	99,396,000	724,014,000	20,012,000	744,026,000
1924, Jan. 1 to May 1	41,825,000	208,496,000	77,194,000	123,745,000	95,884,000	92,575,000	639,719,000	35,277,000	674,996,000

Labor Rates and Conditions Throughout the Country

THE actual physical volume of April construction was the heaviest recorded, for any single month, since the controversies are culminating in long term agreements at existing rates.

With no impending shortage of men or unusual rise in labor cost, attention is directed to production of the basic materials.

The capacity of the nation's mills is evidently geared to war-time requirements and not to the present demands of the consuming public. Mill operations at 90 per cent of capacity might, therefore, be termed "heavy."

Adequate transportation facilities, plus spare mill capacity relieve the dealer and the consumer, alike, of the necessity of buying beyond actual needs or of maintaining heavy warehouse and yard stocks. The mills are accordingly obliged to carry the bulk of the reserve materials stocks of the nation.

The present curtailment policy effective at the mills is the natural result of an effort to bring production nearer to actual consumption.

As fast as signs of depression appear in one direction, indications of increased activities become apparent in another.

For instance, the drop in steel demand and production is met by increased output in the automotive industries.

Curtailments in iron, steel, textiles, coal, chemicals, etc., are offset by increased bank debits and record freight loadings, which indicate assimilation of goods already produced.

The greatest activity, so far as current demand for men is concerned, is divided between agriculture and construction. Local conditions in the building trades follow:

Atlanta—Plenty of skilled building trades mechanics available. Construction active and no unemployment except among the unskilled.

Baltimore—Slight excess of building craftsmen despite an ample construction program. Some of the other industries on part-time.

Birmingham—Construction is steady with conditions particularly good for first class carpenters and structural iron workers. There is an oversupply of common laborers.

Boston—Recent strike of painters ended by granting of $1.25 per hr. Structural iron workers now demand $1.25 per hr. as regular rate; conditions unsettled. Concerning most of the other trades, contractors are united in opposition to further increases. Most of the other crafts are voting on acceptance of proposal to sign a three year agreement on wage schedules.

Chicago—Building very active; all trades busy. Agreement has been renewed with bricklayers to retain the present rate of $1.50 per hr. Marble setters and ornamental iron workers have been advanced 12½c. per hr. since Jan. 1.

Cincinnati—There is unemployment in industries other than construction, particularly among woodworkers and machine tool workers.

Cleveland—Asbestos workers granted rise of 7½c. per hr. No surplus of men in skilled trades. Construction is fairly active but there is depression in some of the smaller machine shops. Automotive plants are busy. Building contractors stand firmly opposed to wage advances. Glaziers, on strike since Mar. 1, returned to work Apr. 22; differences being arbitrated.

Dallas—Building is active but not sufficiently so to take up the present excess of unskilled, common laborers.

Denver—An unprecedented building program is in force. There is some unemployment reported among workers in food products, and steel plants and machine shops.

Detroit—Employment shows slight gain for the month. Volume of construction increasing.

Kansas City, Mo.—Plasterers advanced 12½c. and marble setters, 6¼c. per hr. Plenty of men in other trades.

Los Angeles—Construction, particularly of public work, is increasing in volume. Activity is greatest in dams and sewers, highway work is slowing down pending legislation affecting bond issue and tax. Slight excess of building trades mechanics.

Minneapolis — Surplus of building laborers noted, although construction is gaining rapidly.

Montreal—Trend of employment upward since opening of spring.

New Orleans—Scarcity of bricklayers and plasterers reported. No change in present schedule anticipated before June 1.

Philadelphia—Painters and pipe coverers advanced 5c. per hr. since Jan. 1. No labor troubles prevail and no further changes in the wage rate are anticipated during the current year.

Pittsburgh — Plumbers received increase of 6¼c. per hr. During the past month, building and common laborers struck for an advance of 20c. and hod carriers, 25c. per hr. Agreement reached between employers and hoisting

Current Building Trades Wage Rates Per Hour

(Higher rates indicated by +, decreases by —)

Cities	Bricklayers	Carpenters	Hoisting Engineers	Hod Carriers	Pile Drivers	Structural Iron Workers	Common Labor
Atlanta	$1 12½	$0 70	$0 70	$0 50		$0 75	$0 25@
Baltimore	1 50@1 75	1 00@1 20	1 00@1 12½	1 00	$0 65	1 12½	40
Birmingham	1 00@1 50	35@ 87½	75@1 25	50@ 75		75@1 25	25@
Boston	1 25	1 10	—1 10@1 30	— 70@ 75	1 10	1 10	—.50@
Cincinnati	1 50	1 25	1 25	92½	1 25	1 25	55
Chicago	1 50	+1 50	+1 50	+1 25	+1 50	+1 50	+.75@
Cleveland	1 50	1 25	1 30	87½	1 00	1 50	87½
Dallas	1 50	1 00	1 00	40@ 75	87½	1 00	30@
Denver	1 62½	1 12½	1 12½@1 18¾	81¼@ 87½	1 00	1 15⅜	35@
Detroit	1 50	90@1 00	85@1 00	90	85@1 00	1 12½	60@
Kansas City	1 37½	+1 25	1 12½@1 25	90	1 25	1 25	+ 40@
Los Angeles	1 00@1 25	87½@ 100	75	—.75	—.75	.87½	.50
Minneapolis	1 12½	87½	87½	71½	.....	87½	.50@
Montreal	90	45@ 65	62½	30@ 35	50	65	.25@
New Orleans	1 25	90	1 00	65	+ 85	1 25	.35@
New York	1 50	1 31¼	1 50	1 00	1 00@1 12½	1 50	.50@
Philadelphia	1 50	1 12½	1 02¼	1 12½	1 00	1 12½	.40@
Pittsburgh	1 55	1 37½	1 25@1 37½	1 00	.....	+1 43¾	70
St. Louis	1 75	1 50	1 50@1 65	1 15@1 25	1 50	1 50	.45@
San Francisco	1 25	1 00	1 00	81¼	1 00	1 12½	.50@
Seattle	1 37½	1 12½	1 00@1 12½	1 00	1 00@1 12½	1 12½	.50@

engineers on wage rate of $1.31¼@ $1.43¾ per hr., depending upon the nature of the work. Steam fitters have returned to work after winning an increase of 50c. per day; the agreement expires Mar. 1, 1927.

St. Louis—Hoisting engineers were defeated in their recent attempt to gain an increase in wages; all returned to work Apr. 15. Building laborers have accordingly abandoned their plan for demanding an advance of 12½c. per hr., scheduled to become effective June 1.

San Francisco—Active building program under way. Most of the unemployment is confined to industries other than construction.

Seattle—Nine building crafts secured the five-day week in Seattle. Carpenters received advance of 12½c. per hr., effective May 1, 1925 to May 1, 1926.

New York—Truce prevails between bricklayers and plasterers who went on strike a month ago as the result of a jurisdictional dispute. The men are back at work pending settlement by arbitration.

Monthly Prices of Construction Materials

Ups and Downs of the Market

CONSTRUCTION cost for the entire country is about one per cent below a month ago. No notable price advances occurred during the month, although there is considerable stability in steel rails, steel pipe, tin plates, concrete aggregates and cement. The principal materials affected by declines were: iron and steel, paving materials, hydrated lime, clay products, lumber, wire nails, roofing materials, steel sheets, explosives, lead and linseed oil.

Pig Iron—Market continues slow; prices are about $1 per ton under a month ago and more than $1 per ton below quotations at this time last year. The decline affects all grades and is largely the outcome of a cut in ore and coke prices, resulting in an average drop of $1.12½ per ton in cost of production.

Railway Supplies—Demand for bridge and car materials fairly active. There has been no notable price movement, during the month, in rails, ties and track supplies.

Pipe—Steel pipe, in keeping with standard rails and tin plates, occupies the same price situation as in 1923. Nearly all other steel products are now declining from the advance, started in April, 1923. Since these three items did not rise at that time, no depression is in order at present. A few scattered declines are reported in sewer and c.-i. pipe.

Road and Paving Materials—Street and road lettings have nearly doubled during the past month. Despite this fact, asphalt and road oils are lower in the South and West. The former, however, advanced in New England while paving blocks declined in that section. Paving stone prices are also lower in the Philadelphia district.

Sand, Gravel and Crushed Stone—Aside from slight fluctuations in prices of aggregates on the Pacific Coast, little change occurred in the price line-up for the entire country, during the month.

Lime and Cement—Most of the advances since April were confined to lump lime, there being a slight downward tendency in hydrated at points in the South. Cement is firm, throughout the entire country, at present levels.

Brick and Hollow Tile—Declines may be said to predominate in the current market for clay products. This, however, does not apply to the New York district, where plan filings have increased greatly during the past three weeks.

Structural Steel—The principal heavy rolled steel products are now being quoted at $2 per 100 lb., Pittsburgh, on ordinary tonnages; smaller lots of plates, shapes and bars still hold to $2.10. A year ago, the hot rolled products averaged $2.20@$2.30 per 100 lb. at mill.

Lumber—Production is heavier than a month ago but demand, particularly for pine, appears to be confined largely to structural timbers, railroad material and special cuttings. Dealers show little tendency to purchase for replenishment of stocks. The Northwest fir mills are holding the small gains recently made in new orders and report an increase in domestic cargo business. There is talk, however, of a complete shut-down during June. Most of the price changes of the month were in a downward direction. The notable advances occurred in pine and hemlock at Minneapolis yards; in pine at Detroit and fir in San Francisco.

Iron and Steel Scrap—Activity in scrap could not be expected with the iron and steel industry in its present condition of curtailed production. Heavy melting steel is about $5.50 per ton below the level of a year ago.

Miscellaneous Materials—Firmness is evident in such items as structural rivets, ship spikes and rope. The trend is downward in wire nails, roofing materials, steel sheets, explosives, lead and linseed oil.

E. N.-R. Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Per Gross Ton f.o.b.:

	May 7	One Year Ago
CINCINNATI		
No. 2 Southern (silicon 2.25@2.75)	*$25.05*	$25.05
Northern Basic	*24.27*	24.00
Southern Ohio No. 2 (silicon 1.75@2.25)	*24.27*	24.00
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25@2.75)	*27.47*	28.00
BIRMINGHAM		
No. 2 Foundry (silicon 2.25@2.75)	22.00	22.00 - 23.00
PHILADELPHIA		
Eastern Pa., No. 2X (2.25@2.75 sil.)	*24.26*	24.25
Virginia No. 2 (silicon 2.25@2.75)	*29.17*	28.17
Basic	*23.26*	24.00
Gray Forge	23.75	24.00
CHICAGO		
No. 2 Foundry Local (silicon 1.75@2.25)	**23.00**	24.50
No. 2 Foundry Southern (silicon 2.25@2.75)	*26.55*	27.00
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley (silicon 1.75@2.25)	23.77	25.77
Basic	23.77	25.77
Bessemer	23.77	26.77

SCRAP—The prices following are f.o.b., per gross ton paid to dealers and producers:

	New York	Chicago	Birmingham
No. 1 railroad wrought	$14.00	*$15.00*	$14@$15
Stove plate	11.00	*14.50*	15@16
No. 1 machinery cast	14.00	*18.50*	17@18
Machine shop turnings	9.00	*11.00*	11@12
Cast borings	10.00	*14.00*	15@16
Railroad malleable	13.00	*19.50*	18@19
Re-rolling rails	14.00	*18.00*	20@21
Re-laying rails	20.00	*25.00*	26@27
Heavy melting steel	12.00	.....	.....

Railway Supplies

STEEL RAILS—The following quotations are per ton f.o.b. for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh				
	May 7	One Year Ago	Birmingham	Chicago	St. Louis
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00	$46@49
Standard openhearth rails	43.00	43.00	43.00	43.00	48@52
Light rails, 8 to 10 lb.	34@36	40.00	*33@36*	*36.00*	
Light rails, 12 to 14 lb.	34@36	40.00	*33@38*	*36.00*	2.05@2.15*
Light rails, 25 to 45 lb.	34@36	40.00	*33@38*	*38.00*	1.95@2.10*
Re-rolled rails		37@38			

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8½ Ft.	7 In. x 9 In. by 8½ Ft.
Chicago, White Oak	*$1.70*	$2.00
Chicago, (creosoted) (zinc treated)	**1.85**	2.10
San Francisco, Green Douglas Fir	.84	1.14
San Francisco, Empty Cell Creosoted, Douglas Fir	1.70	2.25
St. Louis, White Oak, plain	1.30	1.50
St. Louis (creosoted) (zinc treated)	**1.80**	2.00
St. Louis, Red Oak, plain	1.15	1.35
St. Louis, Sap pine-cypress	1.10	*1.30*
Birmingham, White Oak	1.25	1.45

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh mill for carload lots, together with the warehouse prices at the places named:

	Pittsburgh					
	May 7	One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	*$2.80*	$3.00	$3.55	$3.65	$4.35	$2.90
Track bolts	3.90@4.25	4.00@4.25	**4.55**	**4.65**	5.85	3.90
Standard section angle bars	2.75	2.75	3.30	**3.50**	4.00	3.85

Pipe

WROUGHT PIPE—The following discounts are to jobbers for carload lots at Pittsburgh mill:

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
	BUTT WELD				
1 to 3	62	50½	1 to 1¼	30	13
	LAP WELD				
2	55	43½	2	23	7
2½ to 6	59	47½	2½	26	11
7 and 8	56	43½	3 to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			

	BUTT WELD, EXTRA STRONG, PLAIN ENDS				
1 to 1½	60	49½	1 to 1½	30	14
2 to 3	61	50½			
	LAP WELD, EXTRA STRONG, PLAIN ENDS				
2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

WROUGHT PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black			
	New York	Chicago	Birmingham	St. Louis
1 to 3 in. butt welded	53%	59½%	62%	49%
3½ to 6 in. lap welded	48%	56½%	30%	46%
	Galvanized			
	New York	Chicago	Birmingham	St. Louis
1 to 3 in. butt welded	39%	48%	50½%	36%
3½ to 6 in. lap welded	35%	45%	13%	33%

Malleable fittings, Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	Birmingham	Pittsburgh	New York	
			May 7	One Year Ago
4 in.	$52.20@54.20	$52.20@56.20	*$57.60@58.60*	$66.60@68.60
6 in. and over	48.20@50.20	47.20@48.20	*52.60@53.60*	61.60@63.60
	Chicago	St. Louis	San Francisco	
4 in.	*$50.70@52.26*	$51.60	*$57.00*	
6 in. and over	*$6.70@48.20*	47.60	*53.00*	

Gas pipe and Class "A," $4 per ton extra.

CLAY DRAIN TILE—The following prices are per 1,000 lin.ft.:

Size, In.	New York May 7	New York One Year Ago	St. Louis	Birmingham	San Francisco	Dallas
3	$48.00	$45.00	$40.00	$45.00		$73.00
4	50.00	55.00	40.00	56.00	$76.50	110.00
5	70.00	80.00		80.00	97.75	118.00
6	92.00	105.00	70.00	100.00	127.50	150.00
8	160.00	170.00	170.00	165.00	212.50	210.00

SEWER PIPE—The following prices are in cents per foot for standard pipe in car load lots, f.o.b., except as otherwise stated:

Size, In.	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3		*$0.081*	$0.10			$0.12	
4		*.081*	.10	$0.10		.15	$0.15
5		*.1215*	.135			.18	.18
6	$0.21	*.1215*	.135	.14		.21	.21
8	.35	*.189*	.21	.225		.30	.325
10	.52	*.2835*	.315	.315		.42	.476
12	.66	*.36¼5*	.45	.405†		.56	.612
15	1.14†	*.486*	.54	.675†		.92	1.02
18	1.65†	*.675*	.75	.945†		1.32	1.53
20	1.98†	*.81*	.90	1.26†			
22	2.65†	*1.08*	1.20				1.564
24	2.97†	*1.215*	1.35	1.62†		2.16	2.04
27	4.65†	*2.405*	2.665	2.45†		3.00	3.34
30	5.16†	*2.665*	2.952	3.00†		3.60	4.06
33	6.98†	*3.60*	3.96	3.55†			4.99
36	8.00†	*4.10*	4.51	3.95†			5.42
		3	5	8	12 24		36
Boston		$0.13	*$0.195*	*$0.30*	*$0.625*	*$2.05†*	*$5.60†*
Minneapolis				.25	.45	*1.50*	4.76†
Denver		.135*	.18*	.27	.47	1.70	
Seattle		.14		.35	.72†	2.60†	
Los Angeles		.1625	.195	.275	.495	1.65	
New Orleans		.115*	.177*	.295	**.5615**	*1.917*	
Cincinnati		.105	.1575	.245	.4725	1.575	4.715
Atlanta		.11*	.15*	.25	.425	1.625	
Montreal		.68‡	.45†	.70	1.35	4.50†	
Detroit		.105	.1575	.245	.4725	2.16†	5.6375†
Baltimore		.111	.166	.259	.499	1.665	4.92
Kansas City, Mo.		.15*	.21*	.32½	.52		
Philadelphia		.12	.18	.28	.54	1.80	4.61

*4-in., 6-in., 9-in., respectively. †Double Strength. ‡3-in. special.

Road and Paving Materials

ROAD OILS—Following are prices per gallon in tank cars 8,000 gal. minimum f.o.b. place named:

		May 7	One Year Ago
New York, 45% asphalt	(at terminal)	$0.065 @ .07	$0.053
New York, 65% asphalt	(at terminal)	*.0675@.0725*	.051
New York, binder	(at terminal)	.07 @ .075	.06
New York, flux	(at terminal)	.07 @ .075	.04
New York, liquid asphalt	(at terminal)	.07 @ .075	.048
St. Louis, 40@50% asphalt		*.0527*	.048
St. Louis, 50@60% asphalt		*.0538*	.049
Birmingham, 55% asphalt		.0475	
Dallas, 45% asphalt		.0495	.0495
Dallas, 55% asphalt		.0455	.0455
Dallas, binder		.061	.061
San Francisco, binder, per ton		12.00*	9.50*

* F.o.b. Oleum, Cal. Freight to San Francisco, 80c. per ton.

E. N.-R. Prices of Construction Materials

ASPHALT—Price per ton in packages (350-lb. bbls. or 425-lb. drums) and in bulk in carload lots, f.o.b. points listed:

	Package	Bulk
New York (*Mexican*)	$23.50*	$19.00
Boston (*Mexican*)	21.50	17.00
Chicago (*Trinidad*)	31.00	15.00
San Francisco, *f.o.b. refinery*, Oleum, Cal.	18.00	12.00
Dallas (*Texas*)	27.10	21.10
Seattle, "*D*" *grade, California, f.o.b. Richmond*	*19.50*	*13.50*
Denver (*California*)	24.00	
Minneapolis, *f.o.b. Twin Cities* (*Standolind*)	27.60	21.60
St. Louis (*Mexican*)	23.75	21.50
Baltimore (*Mexican*)	18.00	14.00
Montreal (*Imperial*)	28.00	21.00
Atlanta (*Mexican*)	29.75	25.75
Detroit (*Mexican*)	22.00	18.00
Cincinnati (*Kentucky Rock*)		11.65
Maurer, N. J. (*Bermudez*)	30.00	28.00
Maurer, N. J. (*Mexican*)	24.00	22.00
Philadelphia (*Mexican*)	22.50	18.00
Kansas City (*Texas*)	27.30	22.30
Los Angeles ("*D*" *grade, California*)	19.50	13.50†
Birmingham (*Mexican*)	27.00	21.00
New Orleans (*Mexican*)	*20.00*	17.00

*In drums. †f.o.b. El Segundo Refinery.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums: 200 to 300 gal. to the ton.

PAVING STONE—

New York (grade 1)	5-in. granite, 30 blocks per sq.yd.	$142.00 per M.
Chicago	About 4x8x4 dressed	per sq.yd.
	About 4x8x4 common	per sq.yd.
San Francisco	Basalt block 4x7x8	70.00 per M.
Boston	5-in. granite, 28 blocks per sq.yd.	130.00 per M.
Atlanta	Granite	2.50 per sq.yd.
Detroit	5-in. Granite	2.00 per sq.yd.
Baltimore	Granite	2.85 per sq.yd.
Montreal	Granite	104.75 per M.
New Orleans	Granite, 4x8x4	3.25 per sq.yd.
Cincinnati	Granite	135.00 per M.
St. Louis	4x8x4	1.65 per sq.yd.
Kansas City	Granite	4.00 per sq.yd.
Philadelphia	Granite	3.00@4.25 per sq.yd.
Minneapolis	Sandstone	2.74 per sq.yd.

FLAGGING—

New York	Bronx, 4 ft. wide	$0.24 per sq.ft.
	Manhattan, 4 ft. wide	24 per sq.ft.
	Queens, 5 ft. wide	26 per sq.ft.
Chicago	6x24-in. cross-walk	1.25 per lin.ft.
	18 in. wide	per lin.ft.

CURBING—*New York*: Bluestone per lin.ft., f.o.b. barge New York, 5x16 in., 88c.; 5x20 in., Queens, $1.00. *St. Louis*: Class "A" straight, delivered, 5x18 in., $1.05 per lin.ft.; roundings, $1.60.

WOOD BLOCK PAVING—

	Size of Block	Treatment	Per Sq.Yd
New York	3	16	$2.51
New York	3½	16	2.82
Boston	3½	18	*2.52½*
Chicago	4	16	*2.25*
Chicago	3½	16	*2.10*
St. Louis	3½	16	2.40
St. Louis	4	16	2.70
Seattle	4	16	Off market
Minneapolis	3½	16	*2.40*
Atlanta	3½	16	2.00
New Orleans	3	16	2.20
New Orleans	3½	16	2.30
New Orleans	4	16	2.40
Dallas	4	18	3.90
Baltimore	3½	16	None used
Montreal	4	16	4.50
Detroit	3	16	1.94
Detroit	4	16	
Cincinnati	3½	16	2.38
Kansas City	4	16	3.95
Philadelphia	4	16	None used

Construction Materials

SAND AND GRAVEL—Price for cargo or carload lots to contractor is as follows, per cu.yd.:

	Gravel 1½ In.		Gravel ¾ In.		Sand	
	May 7	One Year Ago	May 7	One Year Ago	May 7	One Year Ago
New York (*alongside dock*)	$1.75	$1.75	$1.75	$1.75	$1.00	$1.25
Denver	1.90	1.90	1.90	1.90	1.00	1.00
Chicago	2.75	2.00	2.75	2.00	2.75	2.00
St. Louis	1.45	1.45	1.65	1.45	1.18	1.20
Seattle	1.50	1.50	1.50	1.50	1.50	1.50
Dallas	2.38	2.38	2.38	2.38	2.00	2.00
Minneapolis	1.65*	1.85*	1.65*	1.85*	1.25	1.25-1.50
Cincinnati	1.40†	1.40	1.40†	1.40	1.35†	1.35†
San Francisco	2.15	2.15	2.15	2.15	1.50	1.50
Boston	1.50†	1.35†	1.50†	1.35†	1.00†	1.05†
New Orleans	2.60	3.00	2.60	3.00	1.75	1.25
Los Angeles	1.30†	2.15	1.30	2.20	1.20†	1.70
Atlanta	1.90†	2.00†	1.90†	2.00†	1.40†	1.40†
Detroit	2.02	2.05	2.02	1.75	1.62	1.35
Baltimore	1.40	1.40	1.60	1.60	0.70†	0.70†
Montreal	1.25†	1.25†	1.25†	1.50†	1.25†	1.25†
Birmingham	2.00		2.00		1.45†	1.14†
Philadelphia	2.10	2.10	2.10	2.10	1.50	1.50
Kansas City (Joplin chats)	4.00		4.00		0.66*†	0.66*†

New York—Grits, $1.75 per cu. yd.; ready mixed, *$1.80*.
Los Angeles—Freight from quarry, 70c. per ton, and is included in above price.
* At pit. † Per ton.

CRUSHED STONE—Price for cargo or carload lots, f.o.b. city, is as follows per cu.yd.:

	1½ In.		¾ In.	
	May 7	One Year Ago	May 7	One Year Ago
New York	$1.75	$1.75	$1.85	$1.85
Chicago	2.75	2.00	2.75	2.00
St. Louis	1.83*	2.20*	1.93*	2.15*
Dallas	2.40	2.83	2.83	2.83
San Francisco	2.15	2.15	2.15	2.15
Boston	1.60*	1.45*	1.60*	1.45*
Minneapolis	1.75	1.85	1.75	2.00
Kansas City	1.50	1.50	1.50	1.50
Denver	2.50	3.50	2.50	3.50
Seattle	3.00	3.00	3.00	3.00
Atlanta	2.00*	2.00*	2.00*	2.00*
Cincinnati	1.90*	1.90*	1.90*	1.90*
Los Angeles	*1.50**		*1.50**	
Detroit	1.50	1.75	1.50	1.75
Baltimore	2.50	2.50	2.55	2.55
Montreal	1.80*	1.80*	1.90*	1.90*
Philadelphia	2.10	2.10	2.10	2.10
Pittsburgh	2.85	2.85	2.85	2.85
Cleveland	3.25*	3.25*	3.25*	3.25*
Birmingham	2.00		2.00	

*Per ton.

CRUSHED SLAG—Price of crushed slag in carload lots, per net ton, at plants

	1½-In.	¾-In.	Roofing	Sand
Youngstown District	$1.25	$1.35	$2.00	$1.25
Steubenville District	1.25	1.30	2.00	1.30
Ironton District	1.40	1.40	2.00	1.40
Easton, Catasauqua, Pa.			2.50	
Birmingham, Ala.	.90	1.15	2.05	.80
Buffalo, N. Y., and Erie, Pa.	1.25	1.25	2.25	1.25
Cleveland, Ohio	1.30	1.30	1.30	1.30
Eastern Pa. and Northern N. J.	1.25	1.25	2.50	1.25
Western Pennsylvania	1.25	1.25	2.50	1.25
Longdale and Glen Wilton, Va.	1.25	1.25	2.50	
Toledo, Ohio	1.25	1.25	1.50	1.25

LIME—Warehouse prices:

	Hydrated, per Ton		Lump, per Barrel	
	Finishing	Common	Finishing	Common
New York	$18.20	$12.00@$13.10	$3.50*	$2.50@2.75*
Chicago	20.00	18.00		1.21†
St. Louis	24.00	20.00		14.00‡
Boston	20.00	14@15	3.75*	3.00*
Dallas	20.00			1.85†
Cincinnati	16.80	14.30		13.40‡
San Francisco		22.00		1.60†
Minneapolis	25.50	21.00 (white)	1.60@1.70†	1.35†
Denver	24.00			2.70†
Detroit	15.50	15.50	20.00‡	20.00‡
Seattle, *paper sacks*	24.00		2.80†	
Los Angeles		18.00	2.70†	
Baltimore	24.25	17.85	2.55†	
Montreal		21.00		10.50‡
Atlanta	22.50	14.00	2.10†	1.45†
New Orleans	*24.00*	*16.00*	2.00†	2.00†
Philadelphia	23.00	16.00		
Kansas City	19.50	18.50	2.45*	2.10*
Birmingham	22.50	15.00	2.10†	1.75†

*Per 280-lb. bbl. (net). †Per 180-lb. bbl. (net). ‡Per ton

NATURAL CEMENT—Price to dealers per bbl. for 500 bbl. or over, exclusive of bags:

	May 7	One Year Ago
Minneapolis (Rosendale)	$2.80	$2.80
Kansas City (Ft. Scott)	1.35	1.80
Cincinnati (Utica)	1.72	1.72
Boston (Rosendale)	2.50	2.60
St. Louis (Carney)	2.35	1.95
Birmingham (Magnolia) pozzolan cement	2.40	2.10

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots f.o.b. points listed *without bags*. Cash discount not deducted.

	May 7	One Month Ago	One Year Ago
New York, del. by truck	$2.50@2.60	$2.50@2.60	$2.50@2.60
New York, alongside dock to dealers	2.15	2.15	2.15
Jersey City	2.33	2.33	2.33
Boston	2.55	2.55	2.63
Chicago	2.20	2.20	2.20
Pittsburgh	2.19	2.19	2.19
Cleveland	2.39	2.39	2.39
Detroit	2.35	2.35	2.40
Indianapolis	2.41	2.41	2.41
Milwaukee	2.35	2.35	2.35
Duluth	2.19	2.19	2.19
Peoria	2.37	2.37	2.37
Cedar Rapids	2.44	2.44	2.40
Davenport	2.39	2.39	2.39
St. Louis	2.30	2.30	2.30
San Francisco	2.31	2.31	2.61
New Orleans	2.40	2.40	2.40
Minneapolis	2.42	2.42	2.42
Denver	2.84	2.84	2.84
Seattle	2.65	2.65	2.90
Dallas	2.05	2.05	2.05
Atlanta	2.30	2.30	2.35
Cincinnati	2.47	2.47	2.47
Los Angeles	2.80	2.80	3.00
Baltimore	2.90	2.90	2.50
Birmingham	2.40	2.40	2.65
Kansas City, Mo.	2.55	2.28	2.27
Montreal	1.80	1.80	2.72
Philadelphia	2.41	2.41	2.41
St. Paul	2.42	2.42	2.42
Toledo	2.40	2.40	2.45

NOTE—Bags 10c. each, 40c. per bbl.; 20c. each in Canada, 80c. per bbl.

Current mill-prices per barrel in carload lots, without bags, to contractors:

Buffington, Ind.	$1.95	Hudson, N. Y.	$2.05
Universal, Pa.	1.95	Leeds, Ala.	1.95
Steelton, Minn.	2.00	Hannibal, Mo.	2.05
Fordwick, Va.	2.05	Lehigh Valley District	1.95
Mitchell, Ind.	2.05	Wyandotte, Mich.	2.10
Iola, Kan.	1.95	Alpena, Mich.	*1.95*
Mason City, Ia.	2.00	Richard City, Tenn.	2.05
La Salle, Ill.	2.05	Kingsport, Tenn.	2.05

E. N.-R. Prices of Construction Materials

TRIANGLE MESH—Price per 100 sq.ft. in carload lots:

PLAIN 4-INCH BY 4-INCH MESH

Style Number	Weight in Pounds per 100 sq.ft.	Pittsburgh Mill	Birmingham Mill	Warehouse: New York	St. Louis	Dallas	San Francisco
032	22	$0.97	$0.95	$1.39	$1.06	$1.13	$1.20
040	28	1.23	1.20	1.76	1.35	1.38	1.42
068	35	1.51	1.50	2.16	1.66	1.67	1.87
093	45	1.94	1.93	2.77	2.13	2.00	2.40
126	57	2.39	2.38	3.45	2.63	2.55	2.97
153	68	2.86	2.85	4.11	3.14	3.15	.....
180	78	3.28	3.28	5.70	3.60	3.47	.....
245	103	4.33	4.42	6.21	4.75	4.58	.....
287	119	5.00	4.95	7.19	5.50	5.26	6.23
336	138	5.80	5.75	8.35	6.37	6.11	.....
395	160	6.72	6.50	9.65	7.38	7.12	.....
		PAVING					
036P	17	$0.74	$0.75	$1.06	$0.81	$0.76	.....
053P	24	1.04	1.05	1.50	1.14	1.07	.....
072P	31	1.32	1.32	1.90	1.45	1.39	.....
097P	40	1.70	1.70	2.45	1.87	1.90	.....
049R	24	1.04	1.04	.....	1.14	1.07	.....
067R	31	1.32	1.30	.....	1.45	1.39	.....
089R	40	1.70	1.70	.....	1.87	1.90	.....

In rolls, 48-, 52-, and 56-in. wide and in 150-, 200- and 300-ft. lengths. Galvanized is about 15% higher. Size of roll carried in New York warehouses, 48 in. wide x 150 ft. long, or 600 sq.ft.

EXPANDED METAL LATH—Prices in carload lots per 100 yd. for painted:

Weight in pounds	New York	Birmingham	St. Louis	San Francisco	Dallas
2.2	$19.00	$22.00	$21.00	$24.00	$23.50
2.5	20.50	23.00	23.00	26.00	25.00
3.0	23.50	26.00	27.00	30.00	28.50
3.4	25.00	28.00	29.00	.....	31.00

BARS, CONCRETE REINFORCING—Current quotations per 100 lb.:

ROLLED FROM BILLETS

Inches	Pittsburgh Mill	Birmingham	Warehouse, Uncut: New York	Chicago	St. Louis	Dallas	San Francisco
½ and larger	$2.00	$2.25	$3.24	$2.85	$3.15	$3.38	$3.35
⅝	2.10	2.35	3.34	2.95	3.25	3.43	3.45
¾	2.20	2.45	3.44	3.05	3.35	3.48	3.55
⅞	2.40	2.65	3.64	3.25	3.55	3.63	3.75
1	3.00	3.25	4.24	3.85	4.15	3.78	4.35

For size and cutting extras, see bar card of July 15, 1923.

ROLLED FROM RAILS

	St. Louis	Dallas		St. Louis	Dallas
½ and larger	$2.65*	$3.08	½	$3.05*	$3.30
⅝ in.	2.75*	3.13	¼	3.65*	3.48
¾	2.85*	3.18	.....	.....	.....

* Warehouse shipments.

BRICK—Contractors price per 1,000 in cargo or carload lots is as follows:

	Common: May 7	One Month Ago	One Year Ago	Paving Block: 3-inch*	4-inch*
New York (del.)	$17.00	$17.00	$23.65	$45.00	$51.00
New York (at dock)	15.00	15.00	20.00	.....	.....
Chicago	12.00	12.00	11.00	48.00	.....
St. Louis, salmon (del.)	16.00	16.00	16@18	.....	42.50
Denver, salmon	12.00	12.00	12.00	.....	.....
Dallas	12.10	12.10	14.10	35.00	.....
San Francisco	15.50	15.50	15.50	.....	.....
Los Angeles	13.00	13.00	14.50	(not used)	
Boston (del.)	18.00	18.50	22.00	45.00	50.00†
Minneapolis (del.)	13.50@13.60	13.50@13.60	15.00	.....	.....
Kansas City	14.50	14.50	16.50	(no market)	
Seattle	15.00	14.50	15.00	.....	42.50
Cincinnati	17.00	17.00	17.00	40.00	45.00
Montreal	17.50	17.50	17.50	100.00†	68.00
Detroit (del.)	17.50	17.50	17.50	38.50	41.50
Baltimore	18.00	18.00	18.00	40.00	45.00
Atlanta	10.50	10.50	12.00	40.00	.....
New Orleans	15.00	15.00	19.50	.....	.....
Birmingham	12.50	12.50	12.50	40.00	45.00
Philadelphia	19.00	19.00	21.00	40.00	50.00
Pittsburgh (del.)	16.00	16.00	16.00	.....	.....
Cleveland	14.00	14@16	16.00	.....	.....

*For paving blocks 3½x8½x3 and 3½x8½x4 respectively. †Imported.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York: May 7 on Trucks*†	One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco†	Perth Amboy N. J., Factory*
4x12x12	$0.1162	$0.1162	$0.06	$0.1325	$0.08	$0.108	.....
6x12x12	.1743	.1743	.0825	.....	.108	.156	.....
8x12x12	.2179	.2179	.1125	.25	.150	.244	.....
10x12x12	.....	.....	.14	.....	.180	.....	$0.252
12x12x12	.....	.....	.18	.....	.215	.....	.312

*5 per cent off for cash. †Partition tile.

	4x12x12	8x12x12	12x12x12
Boston	$0.09	$0.18	.....
Minneapolis (f.o.b. cars)	.0636	.106	$0.189
Minneapolis (delivered)	.07	.116	.205
Cincinnati	.07485	.13745	.....
Kansas City	.085	.145	.....
Denver	.085	.155	.188
Seattle (delivered)	.10	.20	.30
Los Angeles	.085	.172	.....
New Orleans	.13	.30	.....
Detroit (delivered)	.0775	.1743	.....
Montreal	.12	.225	.30
Baltimore	.125	.27	.....
Atlanta	.0808	.1516	.....
Dallas	.0941	.1824	.265
Birmingham	.11	.1824	.22
Pittsburgh (delivered)	.068	.128	.179
Cleveland	.07	.13	.....

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham, together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh Mill	Birmingham	Warehouse: New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.90@2.10	$2.05	$3.34	$4.15	$3.25	$3.10	$3.30
Channels, 3 to 15 in.	1.90@2.10	2.10	3.34	4.15	3.25	3.10	3.30
Angles, 3 to 16 in., ¼ in. thick	1.90@2.10	2.10	3.34	4.15	3.25	3.10	3.30
Tees, 3 in. and larger	1.90@2.10	2.10	3.34	4.15	3.35	3.10	3.30
Plates, ¼ in. thick and heavier	1.90@2.10	2.00	3.34	4.15	3.25	3.10	3.30

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Pittsburgh Mill	New York—Warehouse: May 7	One Yr. Ago	Chicago	St. Louis	San Francisco	Dallas
½ in.	$2.50@2.60	$4.50	$4.40	$3.50	$3.65	$5.00	$4.75
CONE HEAD BOILER							
½ in.	$2.90	$4.60	$4.50	$3.70	$3.75	$5.20	$5.00
⅝ and ¾	3.05	4.75	4.66	3.80	4.20@4.45	5.35	5.15
⅞ and 1	3.30	5.00	4.90	4.05	4.60	5.60	5.50

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh Mill	Birmingham	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.75@2.85	$2.85	$3.25	$4.00	$4.25	$3.33	4.95
Cut	2.90	2.90	.....	5.25	5.00	3.58	5.00

SHIP SPIKES—Current prices per 100 lb.:

In.	San Francisco: Galv.	Black	Seattle Black
½	$8.00	$6.00	$7.75
⅝	7.30	5.30	5.65
¾	7.15	5.15	5.50

Pittsburgh base in lots of 200 kegs or more, $3.25.

PREPARED ROOFINGS—Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $2.75 per roll to consumers in less than carload lots f.o.b. Philadelphia.

Single shingles, red and green slate finish, cost $7.56 per square (sufficient to cover 100 sq.ft.) in less than carload lots, f.o.b. Philadelphia. Strip shingles (4 in 1) f.o.b. Philadelphia, l.c.l., $5.80 per square.

ROOFING MATERIALS—Prices f.o.b. New York, to consumers in less than carload lots:

Tar felt (14 lb. per square of 100 sq.ft.) per ton	$84.38
Tar pitch (in 400-lb. bbl.), per 100 lb.	1.80
Asphalt roofing (in barrels), per ton, f.o.b. plant	38.81
Asphalt felt (light), per ton, f.o.b. plant	87.75
Asphalt felt (heavy), per ton, f.o.b. plant	87.75

Delivered in Metropolitan Dist., $2.00 additional.

WINDOW GLASS—United inches, 25, bracket size 6x8 to 10x15, single thickness "AA," 82 per cent; "A," 86 per cent; "B," 88 per cent. Double thickness "AA," 82 per cent; "A," 85 per cent; "B," 88 per cent discount from jobbers list at New York warehouses.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.50@2.70	$3.90	$3.80	$4.20	$3.89
No. 12	2.55@2.75	3.95	3.85	4.25	3.94
No. 14	2.60@2.80	4.00	3.95	4.30	3.99
No. 16	2.70@2.90	4.10	4.15	4.40	4.09
Black					
*Nos. 17 to 21	3.30@3.50	4.60	4.30	5.05	4.50
*Nos. 22 to 24	3.35@3.55	4.65	4.35	5.10	4.55
*No. 26	3.40@3.50	4.70	4.40	5.15	4.50
*No. 28	3.50@3.60	4.80	4.50	5.25	4.60
Galvanized					
No. 10 and 11	3.40@3.50	4.80	4.50	5.25	4.60
No. 12 to 14	3.50@3.60	4.90	4.60	5.35	4.70
No. 16	3.65@3.75	.....	.....	.....	4.85
Nos. 17 to 21	3.80@3.90	5.20	4.90	5.65	5.00
Nos. 22 to 24	3.95@4.05	5.35	5.05	5.80	5.15
*Nos. 25 and 26	4.10@4.20	5.50	5.20	5.95	5.30
*No. 28	4.40@4.50	5.80	5.50	6.25	5.60

* For painted corrugated sheets add 30c. per 1,000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per gallon:

	New York: May 7	One Year Ago	Chicago: May 7	One Year Ago
Raw in barrels (5 bbl. lots)	$1.07	$0.95	$1.26	$0.94

E. N.-R. Prices of Construction Materials

WHITE AND RED LEAD—Per 100-lb. keg, base price, f.o.b. New York:

	Dry		In Oil	
	May 7	1 Yr. Ago	May 7	1 Yr. Ago
Red	$15.75	$15.00	$17.25	$16.50
White	15.75	15.00	15.75	15.00

Lumber

Prices wholesale, per M. ft. b.m., to dealers in carload lots, f.o.b.

San Francisco—Prices of rough Douglas fir No. 1 common, in carload lots to dealers at yards. To contractors, $2 per M. ft. additional.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00
4x10 and 12	26.00	27.00	28.00	31.00
3x14	30.00	30.00	32.00	34.00
4x10 and 12	26.00	27.00	28.00	31.00
4x14	30.00	30.00	32.00	34.00

	24 Ft. and Under	25 to 32 Ft.	33 to 40 Ft.
6x10	$28.00	$30.00	$32.00
6x14	**34.00**	36.00	38.00
8x10	28.00	30.00	32.00
8x14	**34.00**	36.00	38.00

New York and Chicago—Wholesale prices to dealers of long leaf yellow pine.

	New York*		Chicago	
	20 Ft. and Under	22-24 Ft.	20 Ft. and Under	22-24 Ft.
3x4 to 8x8	$46.00	$47.00	$29.00	$30.00
3x10 to 10x10	50.00	51.00	33.00	34.00
3x12 to 12x12	55.00	58.00	39.00	40.00
3x14 to 14x14	63.00	64.00	.....	.....
3x16 to 16x16	70.00	71.00	.....	.....
3x18 to 18x18	.....	.....	.....	.....
4x20 to 20x20	.....	.....	.....	.....

* Wholesale price to dealers; to contractors, delivered from lighters or cars to job, $5 additional. Short leaf pine costs $3 per M. less.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 30 ft. for sizes 12x12 and under; for sizes over 12x12 add $2; for merchantable add $2 to sizes 10x10 and under.

Other Cities

	8x8-In. x 20-Ft. and Under				12x12-In. 20 Ft. and Under	
	P.	Fir*	Hemlock	Spruce	P.	Fir*
Boston	$51.00	$48.00†	$50.00	$50.00	$61.00	$58.00†
Seattle		29.50	.....	.....		23.00
New Orleans	42.00	.....	.....	.....	32.00	.....
Baltimore	32.50	49.25	53.00	60.00	38.00	49.75
Cincinnati	37.00	73.00	73.00	85.00	48.00	77.00
Montreal	50.00	58.00	.....	.....	60.00	65.00
Los Angeles	.....	37.00	.....	.....	.....	38.00
Denver	.....	33.75	33.75	33.75	.....	34.75
Minneapolis	**43.00**	39.75	36.00	.....	**44.50**	39.75
Atlanta	32.00	.....	.....	.....	35.00	.....
Dallas	52.25	.....	.....	.....	56.00	.....
Kansas City	42.00	40.75	.....	.....	53.60	41.75
Birmingham	32.00	.....	.....	.....	34.00	.....
Philadelphia	56.00	32.00	37.00	40.00	64.00	32.00
Detroit	47.75	51.75	.....	.....	57.75	51.75
St. Louis	40.00	.....	.....	.....	48.00	.....

	1-In. Rough, 10 In. and Under x 16 Ft.			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir*	Hemlock	P.	Fir*
Boston	$45.00	$42.00†	$44.00	$50.00	$48.00†
Seattle	.....	25.00	.....	.....	29.00
New Orleans	80.00	.....	.....	40.00	.....
Baltimore	55.00	44.00	44.00	34.00	50.00
Cincinnati	70.00	79.00	75.00	38.00	85.00
Montreal	56.00	50.00	45.00	45.00	45.00
Los Angeles	.....	32.00	.....	.....	81.00
Denver	.....	34.75	34.75	.....	32.25
Minneapolis	43.00	37.75	**35.75**	**38.00**	35.25
Atlanta	20.00	.....	.....	30.00	.....
Dallas	52.25	.....	.....	55.73	.....
Kansas City	73.25	66.75	.....	77.00	70.25
Birmingham	19.00	.....	.....	.....	.....
Philadelphia	32.00	31.00	36.00	54.00	32.00
Detroit	37.25	**40.50**	.....	45.50	**41.25**
St. Louis	42.50	.....	.....	31.00	.....

Birmingham—Quotes carload lots, f.o.b. sidings; $4.00 additional per M. ft. to contractors.
Boston and Cincinnati—Prices to contractors in carload lots, f.o.b.
Denver—Quotes dealers price to contractors on large projects.
St. Louis—Wholesale price to contractors, f.o.b. cars, $2 per M.ft. additional.
Seattle—Price to contractors, delivered.
Dallas—Wholesale to contractors, $10 per M.ft. additional.
*Douglas fir. †Prime.

PILES—Prices per lineal foot, pine piles with bark on, f.o.b. New York.

Diameters	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.14½	$0.18½
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.19	.23½
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.21½	.25½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.25½	.34
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.27½	.36½
14 in.—2 ft. from butt	5 in.	80 to 89 ft.	.35	.45

Miscellaneous

STEEL SHEETPILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

May 7	One Month Ago	One Year Ago
$2.15@2.25	$2.15@2.25	$2.40@2.50

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern Territory New York and East of Missouri River
Plow steel round strand rope	35%
Special steel round strand rope	30%
Cast steel round strand rope	20%
Round strand iron and iron tiller	5%
Galvanized steel rigging and guy rope	7½%
Galvanized iron rigging and guy rope	+12½%

California, Oregon, Nevada and Washington: Discount 5 points less than discount for Eastern territory.
Wyoming, New Mexico and Colorado: Discount 5 points less than discount for Eastern territory.
Arizona: Discount 10 points less than discount for Eastern territory.
Montana, Idaho and Utah: Discount 10 points less than discount for Eastern territory.
North Dakota, Nebraska, Kansas, Oklahoma and Texas: Discount 5 points less than discount for Eastern territory.

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft., there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ¾-in., 8 ft.; ½-in., 6; ½-in., 4½; 1-in., 3½; 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ¾-in. and larger, in 1200-ft. coils:

Boston	$0.18@.22	New Orleans	$0.26
New York	.27	Los Angeles	.19
Chicago	.21½	Seattle	.17
Minneapolis	.28½	St. Louis	.26½
San Francisco	.26	Montreal	.16
Atlanta	.26	Detroit	.19
Denver	.30	Baltimore	.18
Cincinnati	.21	Kansas City	.21
Dallas	.30	Birmingham	.21@.23
Philadelphia	.18		

EXPLOSIVES—Price per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.27	$0.295
Boston	.225	.25
Kansas City	.2025	.2225
Seattle	.165	.19
Chicago	.1525	.1775
Minneapolis	.1917	.2123
St. Louis	.22	.245
Denver	.2025	.2275
Dallas	.225	.302
Los Angeles	.1875	.2125
Atlanta	.23	.255
Baltimore	.22	.23
Cincinnati	.22	.245
Montreal	.195	.235
Birmingham	.23	.255
New Orleans	.233	.26
San Francisco	.1625	.1925
Philadelphia	.215	.24

CHEMICALS—Water and sewage treatment chemicals, spot shipments in carload lots, f.o.b. works:

Sulphate of aluminum, in bags, per 100 lb.	$1.40@1.45
Sulphate of copper, in bbl., per 100 lb.	4.65@4.85
Soda ash, 58%, in bags, per 100 lb.	**1.38**
Chlorine, liquid, tanks, per lb.	.04½
Hypochlorite of lime (bleaching powder) in drums, per 100 lb.	2.00@2.10

FREIGHT RATES—On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Baltimore	$0.31	Detroit	$0.29
Birmingham	.58	Kansas City	.735
Boston	.365	New Orleans	.67
Buffalo	.265	New York	.34
Chicago	.34	Pacific Coast (all rail)	1.15*
Cincinnati	.29	Philadelphia	.32
Cleveland	.19	St. Louis	.43
Denver	1.15*	St. Paul	.60

* Minimum carload, 50,000 lb., structural steel only; 80,000 lb., for other iron or steel products.